# Transactions
# American Laryngological Association

Forty-fourth Volume

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# TRANSACTIONS

OF THE

FORTY-FOURTH ANNUAL MEETING

OF THE

# American Laryngological Association

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TRANSACTIONS OF THE FORTY-FOURTH ANNUAL CONGRESS

OF THE

# AMERICAN LARYNGOLOGICAL ASSOCIATION

HELD AT

WASHINGTON, D. C., MAY 1, 2 AND 3, 1922

## REGISTRATION

The Forty-fourth Annual Congress of the American Laryngological Association was called to order, Monday, May 1, 1922, at 10 A.M., by the President, Dr. Harmon Smith, at the Hotel Raleigh, Washington, D. C. The following Fellows enrolled during the session.

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McCullagh, Samuel
McKimmie, Oscar A. M.
Mackenty, John E.
Mayer, Emil
Monroe, Otho Lee
Mosher, Harris P.
New, Gordon B.
Packard, Francis R.
Pierce, Norval H.
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Richardson, Charles W.
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Wilson, J. Gordon
Winslow, John R.
Wood, George B.
Wright, Jonathan

# ADDRESS OF THE PRESIDENT

HARMON SMITH, M.D.

It is with pardonable pride, commingled with great misgivings as to my own fitness, that I begin my address to you today. Mere words cannot express the elation and stimulation produced in my mind by the manifold evidence of your confidence, nor can imagination or fancy add to the inadequacy of words, for when I look back to 1908, the year of my election as a Fellow of this Association, it is with proud humility that I recall my election to every office in your power to bestow save that of librarian, and for these honors nothing will suffice but the brief and heartfelt words, "I thank you."

I shall not attempt a scientific presentation of matters pre-eminently within our domain, although so many of my abler predecessors have done this; but, on the contrary, I shall endeavor to have you accompany me in visualizing our present status, scientific, intellectual, and social.

Many organizations, with aims and endeavors similar to ours, lay greatest stress upon the scientific attainments of applicants for membership, oftentimes to the almost total exclusion of their intellectual and social standing. This is not a detriment to their Association, nor am I here voicing an adverse criticism of such action; it is rather commendable, because there must be societies whose gates are open to any and all who have established new scientific truths or who have perfected theories and devices already in existence. In our profession there is ample room and place for societies where the interests of all may and can be advanced. But in our own limited, circumscribed coterie of laryngologists we must endeavor to maintain that extremely high status that was fixed at our inception and we should admit only those who have proven themselves worthy of wearing the senatorial toga—men fully equipped not only scientifically but intellectually,

superior in each equipment and certainly possessing such social knowledge that they may not exacerbate the sensitiveness of the older and more prominent Fellows. Our aims and aspirations should not be that we may fill our full quota of membership nor to crowd our program with numerous essays, but rather to emphasize merit at the expense of numbers, remembering the ancient proverb that "Much is not Many."

There are, no doubt, times when the pessimistic element among us deplores the present-day paucity of scientific material, but I believe this is merely a lull in our advancement; peradventure, the next year may see the Secretary overwhelmed with offers of invaluable papers. During my seven years' incumbence in the office of Secretary I was in a position to become peculiarly familiar with presentation of scientific material, and I am strong in the belief that if any five years be chosen haphazard from the *Transactions of the American Laryngological Association*, those five years will equal if not surpass in the new material presented, in the method of its presentation, and in its value to science those of any of our contemporary societies for an equal period of years. We should endeavor to make this Association the ultimate object of attainment of the aspiring laryngologist after he has passed through the melting-pot experience of other societies. All those invaluable contributions of our predecessors must of necessity stimulate and inspire us to leave a similar imprint upon the pages of our *Transactions*. Here let me say that some have complained, perhaps I should say remarked, that the new members contribute but meagrely to our program. This is in itself an admission that they stand almost in awe of the elder members still so active, still filling the program so liberally, that there is no room for further contributions; it seems only fitting that the younger members should bide their time, a time when they, too, will be filling the program to the exclusion of members younger than themselves. The great Supreme Court is not made up of young jurists, but, on the other hand, of men who have been tested in the crucible of the court or upon the bench of a lower court. As in the law so it is with our Association, and so it must be with every great concern of this life—the whole constitutes a continuous progression.

And now, gentlemen, there is another matter that has long occupied the thoughts of many members of this body, and that is a deeply seated hope that at some no distant day personal preferences, prejudices, and antagonisms may all be submerged and in their stead may arise a uniform and harmonious desire to see science advance by the union and amalgamation of the two leading special associations in America; and the hope that while each shall cling to its own beliefs and tendencies, each may be charitable and yielding enough to compromise a little with the ideas and aims of the other. Union would lessen the expenditures of both societies, would increase the knowledge of each in the other's particular field, and would induce and finally cement a friendship advantageous to each. The rising specialist of tomorrow will, perforce, be compelled to familiarize himself with the ear as well as with the nose and throat, and while there is in existence a society offering him ample and valuable opportunities in which to display his knowledge in both fields, this very society must in time become so unwieldy and topheavy that there must come into being another and more exacting society which shall offer similar opportunities, and which will then occupy the position of arbiter in these respective fields.

So very recently have we witnessed the evidences of a desire among the various nations of the earth to bury the hatchet, to reduce armaments, to scrap navies, to disband armies, to curtail expenses, and, above all, to prevent needless death, that we should feel that we too must quell all personal desire and only look to the greatest good of the greatest number. And similar to this international gathering we too are here assembled to exchange helpful views, to offer suggestions, to issue warnings, to disseminate broadcast our methods of alleviating suffering, to forestall disaster by preventive measures, and to reduce the occurrence of accidents to a minimum. When we do this we place our branch of science on a very high pinnacle that is unassailable by the gibes of the sordid, the sneers of the mercenary, or the quibbles of the envious. We are gathered here in conference that all that is written or spoken may become part and parcel of our beings. The physical contact of men in convention, the element of man to man, the existence of that intangible quality—personality—

all combine to make the mental output leave on the memory of those present an indelible stamp. The great Goethe emphasized the dominant force and tremendous effectiveness of mere presence in a conference. No doubt the great poet was far from denying the value of solitary study, of burning the midnight oil, of poring over dusty tomes written by learned predecessors and pioneers; nor is there one among us here who would deny such value to study and contemplation, but I believe we all think that, in the end, everything must yield to the human presence, and to that feeling so often and tersely expressed by those three words, "Man to Man."

And these three words conjure up in my mind men of imperishable fame who within my own memory have brought about such monumental advances in our special branch of science. First among these notable figures rises that of our Nestor—Solis-Cohen—who was the first to successfully perform laryngectomy. Then came our great confrère, Lefferts, who directed his attention almost entirely to the larynx and became supreme in his activities within his chosen field—a field small, it is true, but one which he lived long enough to see so extended that it embraced also the nose and the diseases of the accessory sinuses. After Lefferts came Bosworth, whose scope in the beginning embraced the larynx, nose, and accessory sinuses, but who lived to see this very large field so extended as to cover the major surgery of the neck, the complete removal of the larynx, not as an exception but as a routine in cases of cancer, the removal of the thyroid gland and almost all other neck surgery.

Today the laryngologist not only labors in these regions but adds to them bronchoscopy, esophagoscopy, and brain surgery. And so in a comparatively short space of time, from the small area in which worked Lefferts and his contemporaries, there appears a new kingdom created by the man of today which not only takes in all surgery above the neck but invades the inner man, the thorax, esophagus, and bronchial tubes, even to the ultimate end of his respiratory and deglutory organs. Of course, to conclude from these advances and extensive excursions that we today make, that it is possible to go so far as to make men in our special branch into proctologists, is, without doubt, a bit

premature. So also we may regard as rather transcendentally suggestive the notion that we may ultimately become gynecologists, because some operations on the nose have favorably influenced multifarious dyscrasiæ peculiar to women. How far we may reach—indeed, just how far we may be forced to reach—might be further predicted from a knowledge of those well-recognized facts that the greater number of focal infections are attributable to diseases peculiar to our profession—infections of the teeth, tonsils, and sinuses. But after all these are but things of the recent past. Today we are offered problems as novel, as full of burning questions, and as complex as those that amazed and startled us in the past. Sensitization is today practically an unknown and unexplored field for the majority of us, and we constantly witness numbers of our own special group invading the province of the general practitioner, treating asthma and hayfever by means of desensitization. Furthermore, radium and the roentgen ray find their widest and most general application in our own sphere of activities, and once again we observe what was in the beginning a small area of invasion of disease having a limited treatment and a limited surgery almost magically enlarged to an unlimited field, where all that is old and tried in surgery still prevails with primitive force, and yet where there is ever-increasing employment of vaccines, light, and heat.

And now in saying this, my valedictory, to you, may I not compare this assembly with the gathering of the early Greek colonists at the sacred fire which ever burned on the great home altars and at which each departing colonist lit in turn his light to carry far and wide—ever aglow and ever illuminating the regions into which he carried—civilization, culture, art, and science.

# OBSERVATIONS ON THE ART AND TECHNIC OF BRONCHOSCOPY AND ESOPHAGOSCOPY

THOMAS HUBBARD, M.D.

THE voluminous publications on this subject rather deter one from attempting to interest those who have encountered and solved most of the problems connected with the diagnosis and operation for removal of foreign bodies from the lower air passages and esophagus. But the very nature of this work—the variety, the pathologic complications, and the emergency features—gives each operator a different angle of observation, and personal experiences and conclusions aid in establishing sound methods.

Coincident with the development of bronchoscopy we realize the importance of the study of the various types of dyspnea. The foreign-body idea rather takes the lead in the minds of the well-read profession and laity and the bronchoscopist is liable to be called upon to make a crucial diagnosis in cases obscure because of unusual symptoms, vague history, and conflicting circumstantial evidence. For instance, he must decide between thymus or peribronchial gland pressure and foreign body dyspnea. In other words one must keep in mind certain contraindications to bronchoscopy.

The same discrimination must be exercised in the study of dysphagia. Esophagismus, hysterical dysphagia, cardiospasm or acute thymus pressure, inflammatory lesions or a malignancy may turn up unexpectedly in connection with the foreign-body question. Rheumatic esophagitis may simulate the foreign-body trauma. These are passing suggestions of diagnostic questions, demanding prompt decisions, forced upon the bronchoscopist because he specializes in relieving dyspnea and dysphagia.

Certain features of management and method will now be considered. The current literature gives the impression of a tendency

to disregard some of the accepted rules of "deliberate surgery." That term is very commendable. Laryngology has experienced reactions in certain operations following exploitation of methods that ignored the admirable precept expressed by the word "deliberate." It suggests not only adherence to rules which are essential to good surgery, but it also takes into consideration the personal factor, the operator, and implies that he shall adapt method, technic and the time factor to the end that his talents have free play—all essential to surgical success.

Precision is a safer ideal than brilliancy. The central idea of sound teaching should be the establishing of practical standards. Operative speed varies with individuals as well as methods and consequently the fixing of a time limit for bronhoscopy may disturb the equanimity of the deliberate operator. Dr. Jackson may take it as a compliment that this paper is partly in the nature of comments on his teachings. He has brought an unusual honor to American surgery, but we do hope that he will some day settle down to a comfortable Philadelphia pace.

Under the heading "method," one naturally thinks first of anesthesia. This refers, of course, to general anesthesia. This should be decided in accordance with the conception of the term "deliberate surgery." In foreign-body bronchoscopy one undertakes a surgical operation of undetermined and perhaps extreme difficulty. It is easy to scare up arguments against ether anesthesia in all kinds of operations. Some are valid and some are not. Occasionally the risk is forced. One cannot generalize. Postulates express the individual preference too positively. Each case is a study, and I desire merely to convey the conviction that prohibition of anesthesia is a handicap and tends to establish an impractical standard. But I would qualify endorsement of general anesthesia, when indicated, by the statement that the anesthetist must be one prepared to aid in the emergency disturbances incident to the operation: He must know the danger signs, warn the surgeon timely, and know the restorative indications. The oxygen outfit is essential for this purpose. Posture is important, and he should be experienced in this matter.

Supposing that there be dyspnea in the case presenting for bronchoscopy. First determine the location of the obstruction:

Laryngeal, foreign body in the trachea or bronchus, pnuemonia, or a flooded lung. In so far as laryngitis is concerned it is my experience that ether anesthesia will relieve a spasmodic, croupy dyspnea, and I would add that in the hands of the average operator there is less danger of laryngeal trauma in passing the bronchoscope in the quiet, anesthetized patient. Several of the cases in this collection had laryngeal dyspnea prior to operation, but in none has there been serious aggravation by operation. Fortunately emesis is physiologically inhibited by intubation of the larynx. No emesis with the open glottis. This makes the no anesthesia method possible but does not condemn anesthesia. The question of tracheotomy in laryngeal dyspnea will be considered later.

A tracheal or bronchial dyspnea is not a contraindication to ether (plus oxygen if needed), and I would say the same of even bronchial flooding, often misnamed pneumonia. It is in precisely the type of case having dyspnea that deliberate surgery is essential. The cause must be removed and the operator should feel at liberty to select that method which gives him the best chance of successful operation.

Sudden asphyxiation is usually due to one of three causes: Either it is shifting of the foreign body blocking the trachea or glottis, or it may slip over into the open bronchus, or it may be due to the release of pent-up secretions of the invaded bronchial tract overflowing into the functioning lung. In the first instance prompt insertion of the tube will displace it into the trachea, giving temporary relief, or it may be grasped in the larynx. In the other emergencies one must depend on aspiration and removal of the foreign body.

This complication, sudden asphyxia, occurring before or after removal of the foreign body, has caused fatality on the table, and it is probably the basis of prejudice against general anesthesia. But as we get experience and study all of the factors the apparent objections to anesthesia are less convincing. In my experience the aspirator is the life-saver.

This matter of bronchial flooding in foreign-body cases introduces a question of pathology. We are in the habit of labeling a case pneumonia or bronchopneumonia when there is percussion dulness, typical rales, diminished or no respiratory sounds,

limited thoracic expansion, confirmed maybe by the fluoroscope; but we should bear in mind that there is often absence of evidence of a real infection inflammation. There may be considerable fever, due perhaps to the retained secretions. In peanut aspiration there are fragments, mouth contaminated and irritating, which produce excessive secretion in bronchi and bronchioles; but there is another factor in cases having actual plugging of a main or secondary bronchus. Intrapulmonary air pressure is normally minus 1 or 2 mm. Hg inspiratory and plus 2 to 5 mm. Hg expiratory in quiet respiration. In forced respiration, as in dyspnea from an obstructed air passage, the inspiratory negative pressure may be as high as minus 57 mm. Hg and in expiration plus 80 mm. Hg. This extreme change of pressure from the normal tends to engorge the delicate vascular mucosa of bronchi and bronchioles and alveoli. The still higher positive expiratory pressure would tend to unload the congested vessels, but in dyspnea due to a plugged bronchus we have an almost continuous high negative pressure below the point of obstruction of one pound (−50 mm. Hg−2 inches Hg), more or less, varying with the degree of obstruction and the age and vigor of the subject. (Two pounds negative pressure will cause decided hyperemia of the nasal mucosa, four pounds will draw blood, and that too in tissues more tolerant of high negative pressure.) Irritation hyperemia plus negative pressure seems to account for the rapid flooding of a bronchial tract below the point of obstruction. Limited thoracic expansion is one of the cardinal symptoms of obstructed bronchus. There is evidence that this is due in part to physiologic inhibition, but it is also an indication that the air content is displaced by fluid. But this is not a true pneumonia nor an inflammatory edema, as has been made clear by McCrae, Spencer, and Jackson. The proof of this is found in the fact that in many of these cases the removal of the foreign body and deep aspiration will promptly restore lung function, and within a few hours respiration becomes quite normal and the fever vanishes. Retained secretion is a foreign protein and causes the rise of temperature. A brief report of three cases will make clear the important points and the operative indications:

A baby of sixteen months had a fragment of peanut in the right bronchus for seven days. The physical examination, malaise, temperature, and coughing warranted the usual diagnosis of bronchopneumonia. The infant nearly passed away from the flooding of the open bronchus after removal of the foreign body. With the tube *in situ* the mucus could be seen to well up in the tube until it reached the level of the breathing fenestra, and as it overflowed into the left it caused asphyxia and cyanosis. The pulse remained normal. Prompt removal of the tube, which was filled with the thick, tenacious mucus, turning the infant to the right side, and then upending it caused the overflow to come out of the mouth. Aspiration would have been better, but we tried the posture method in this case and it was effective. This patient had no fever after operation and recovered so promptly that the diagnosis of bronchopneumonia was not confirmed.

Another case, that of a boy of three and a half years, was sent to Toledo Hospital with a diagnosis of "arachidic bronchitis" of four days' duration. The fever ranged between 102° and 104°. The radiographic plates showed the left lung to be almost airless, limited expansion of the left thorax, no excursion of the left diaphragm observed by fluoroscope, no respiratory sounds in the left thorax, respiration very rapid, and the patient quite exhausted. Two peanut fragments were removed from the lower left bronchus—Dr. Galbraith operating. Probably they plugged both secondary bronchi, which accounted for complete obstruction. In this case the overflow of mucus was prevented by aspiration. The contents of the wash bottle illustrate the importance of thorough, deep aspiration. (See lantern slide.) Small pieces of peanut and debris in a large amount and an ounce or two of thick, tenacious, somewhat purulent mucus accounted for the findings of the physical examination and the high temperature. Retained secretions caused the fever. As an additional precaution this patient was turned on to the affected side even after aspiration. There was prompt relief of coughing and no fever after operation. An hour later air was entering this lung almost normally. (See lantern slide.)

Metallic foreign bodies blocking one or more secondary bronchi will produce about the same degree of fever and the same symptoms of pneumonia. A brass pencil-cap lodged low down in the left bronchus gave a clinical picture very similar to the last-mentioned case, and

the symptoms of bronchopneumonia vanished as soon as the pent-up secretions were withdrawn after removal of the foreign body.

These three cases added to the group presented by lantern slide total about twenty with one fatality from postoperative pneumonia four days after operation. Three other cases were seen in terminal stage of pneumonia from peanut aspiration.

It is evident that infection is in such cases of slight degree and that the seromucus flow is chiefly due to irritation and the almost continuous high negative pressure below the point of complete obstruction. The inference is that the term bronchopneumonia overstates the pathologic condition. It is more of the nature of a negative pressure bronchorrhea. "Arachidic bronchitis" implies a type peculiar to peanut aspiration, and undoubtedly in this accident irritating; mouth contaminated debris is liable to enter small bronchioles, but it is probable that any foreign body that plugs the main bronchus or one or more secondary bronchi will cause about the same symptoms.

The surgical lesson is that the operation for removal of a foreign body from a bronchus is not complete until the debris and pent-up secretions are evacuated as thoroughly as possible, and as a precaution against overflow into the open bronchus the patient should be turned on to the affected side.

Now a few words concerning tracheotomy: The lantern slides and legends show the contrast between prebronchoscopic days, the early period of bronchoscopy, and present-day practice. The real indications for tracheotomy are either of an emergency type or to aid in certain extraction problems. For instance, in laryngeal impaction tracheotomy may be forced. An extreme degree of laryngeal obstruction will cause anxiety even after extraction of the foreign body which has caused it, and rather than run the risk of being forced to do it in a hurry, it is well to get a cannula in promptly. I have had no experience with postoperative intubation, but an inflamed larynx does not tolerate a tube well and extubation is liable to be delayed—a rather serious complication. As stated none of the cases in this series showed postoperative evidence of laryngeal trauma.

In foreign-body lung abscess tracheotomy is indicated to aid in the aspiration of purulent contents. It is a nasty job to work showered with foul pus, and this can be avoided by a few days of frequent aspirations prior to exploration by the bronchoscope.

The lower route aids in reaching and exploring the orifice of the upper right lobe bronchus for removal of a foreign body, the angle of approach being more favorable than by the upper direct method, and also the shorter tube makes easier the mechanical manipulations in complicated conditions conducted, if necessary, under the guidance of the fluoroscope.

There is an interesting phenomenon connected with this matter of prying around in the trachea and in the bronchus. I have observed syncope not due to asphyxiation—a sudden slowing of the pulse-rate. In one case my associate, Dr. Galbraith, was searching the lower left bronchus for some more peanut fragment —two already extracted. The pulse dropped, as the anesthetist estimated, to less than thirty, and it promptly came back to normal when the extension tube was adapted to the proper axis. Pressure on or tension of the vagus filaments to the cardiac plexus may be the cause of inhibition. It is the duty of the anesthetist to watch for such disturbances and warn the operator timely. Probably some fatalities of this type are ascribed to *status lymphaticus* or other cause.

The nature of esophagoscopy is similar to bronchoscopy, but the anatomical construction and the fact that, as a rule, impaction complicates and adds a factor of trauma. Above all, this work must be deliberate, and to that end general anesthesia is indicated, excepting, of course, in the obviously easy ones. Untimely emesis may become a real complication. Dr. Jackson has delineated the complicated mechanical manipulations necessary, and certainly one must have the aid of complete relaxation and forget the time limit to do this kind of work deliberately.

Posture is a matter of great importance. In adults one can get a suggestion of the esophageal axis by examination of the dorsal vertebral curve. I think that the operator can keep his sense of orientation better by the supine horizontal posture as the standard, varying slightly to keep exactly in the axis of the tube explored. (Exhibit—a special pillow to support shoulders and head for esophagoscopy and bronchoscopy.)

A few words about open safety-pins in the esophagus: The most popular type is made of brass, and fortunately this is less dangerous than the plated steel pin, as it is less sharp and more flexible. In the group presented of fifteen cases, the hook method of reversing the point was used. Only one was extracted by forceps, and that is the only case in which there was trauma. This child had a throat infection on the way, having traveled far, and the trauma of extraction aggravated the cervical adenitis and general cellulitis. In this case the guard was imperfectly attached and was pulled off by the hook, leaving the pin crosswise until it was grasped by forceps and extracted.

It should be added that one must study the plate measurements to determine if turning the open pin is possible, and if not the shield-hook method covering the point and pulling it into the beveled lip of the tube—or the method Dr. Jackson now advises should be resorted to, that is, grasping the point and shielding it in the beveled tube end.

As to instruments, my experience is limited to the Killian outfit—proximal illumination by the Bruenings's Kirstein headlight, telescopic tubes, etc., with the addition of Jackson strong forceps which are indispensable for heavy esophageal work. In addition I find that the shield hooks are very useful and safe not only to make forceps space but also to relieve impaction. The Bruenings headlight has proven very satisfactory. There is no doubt but that the Jackson distal illumination method is better in some respects, more brilliant and it gives a better idea of the location of the forceps; but in the hands of the average man who operates a few times a month the more simple the electric outfit the better. One advantage of the Bruenings headlight is that one can keep in practice by using it for general throat surgery.

This special art has enabled the trained vision to penetrate deeply into the naturally obscure anatomical regions to meet surgical indications with precision and study with accuracy hidden pathology. I should like to put into words sentiments of appreciation of the work of the founders of this surgical art. Endoscopy is peculiarly spectacular, and it is high-tension work with startling end-results. Following the moment of the exaltation over a surgical achievement there comes to mind the men who have written

this chapter in the history of laryngology. Joseph O'Dwyer developed the art of intubation of the larynx; Gustav Killian applied the idea, and Bruenings and von Eicken contributed their talent; Ingalls and Coolidge imparted the inspiration to their colleagues; Jackson has blazed a new way in the perfection of the technic and instrumentation and established standards that will keep the next generation alert; Mosher, Lynch, Arrowsmith, and Lynah have done foundation work in special lines; many others have contributed to perfect detail. These men have created an epoch in surgery. We honor them when we realize on their ideals.

[[1] Lantern slide exhibit of specimens and special pathologic conditions.]

## Discussion

Dr. Chevalier Jackson, Philadelphia, Pa.:

I have for a great many years admired Dr. Hubbard's work, and now even more more than ever. He showed records of a beautiful series of cases this morning, wonderfully carried out and accruing with wonderful results to the benefit of the patients. My experience corroborates almost everything he said. There are, however, one or two points to which I would take exception: First, in regard to the matter of anesthesia. I think we all must admit that cocain in very young children is dangerous. I know Dr. Freer does use it in operating on the septa of children, but in infants of six months or a year of age I do not think even Dr. Freer would risk cocain. So I think we can rule out cocain in very young children. In the use of general anesthesia the only kind of dyspnea that I regard as dangerous is obstructive laryngeal dyspnea, in which the patient is using his accessory muscles of respiration in making a fight for air. If you put them out of function by artificial sleep the patient has nothing with which to breathe, and he dies unless a very prompt and efficient bronchoscopic oxygen insufflation is done. I also think a laryngologist should be able to look at the larynx of a child without anesthesia. These are the only conditions in which I object to general anesthesia.

So far as anesthetizing any particular case is concerned, I think every man should do what he thinks is best for his patient. Personally I like the coöperation of the patient and prefer to work without anesthesia; but each bronchoscopist should follow the dictates of his own conscience in the matter. In regard to the time limit on broncho-

copy, Dr. Hubbard used the word deliberate. The antonym of deliberate is precipitate. For years I have deprecated precipitate work in bronchoscopy. It has led to more disaster than anything I know of. It was Dr. Ingals who first discovered that prolonged bronchoscopies in children are dangerous, and my experience corroborated his observation. When I put a time limit at which I intend to stop, everyone in the operating room knows that my stop-watch is running against them, consequently there is no time wasting. I want all of that time for deliberate work with my eye at the tube. It does not accrue to the benefit of a six-months-old infant for me to have to wait while somebody runs out to get and sterilize a forgotten instrument. Before we start everything is supposed to be ready and to come over my ear promptly when I ask for it. In other words, the stop-watch contributes not to precipitate bronchoscopy but to deliberate bronchoscopy. In regard to a plugged bronchus and plus pressure to which Dr. Hubbard referred, and of which the President asked that I speak in the discussion, there is one point which Dr. Hubbard did not mention, namely, the plus pressure of obstructive emphysema due to valve-like obstruction, first discovered by Iglauer and elaborately studied by Manges. How much this plus-pressure is I do not know; it is enough to move the heart and mediastinum over to the other side at each expiration.

In regard to the technic of protecting the point to which the President asked me to refer, Dr. Hubbard's hook seems excellent. The best method of closing a safety-pin, I believe, is with the Arrowsmith closer. With it you can close a safety-pin with only one instrument, and that a very small one. It is a beautifully designed and constructed instrument. I do not close as many safety-pins as formerly. The point-protected method has been so improved by the Tucker forceps that I find this method now ideal.

Of the physical signs, I think one of great importance is limitation of expansion on the invaded side. It seems strange that a pin causing no obstruction to the free admission of air will cause limitation of expansion on the invaded side. This limitation of expansion will disappear sometimes within two or three hours, in other cases within two or three days, after the removal of the pin. This phenomenon was discovered by Dr. McCrae at the Jefferson Hospital. I heartily endorse the advocacy of aspiration. I have found it a life-saving procedure. I must differ with Dr. Hubbard in regard to his skepticism of the toxicity of the peanut, and I know some day he will agree with me. The peanut produces a toxic reaction. The peanut produces the flooding, which is the effect not the cause. A tack does not produce

flooding because it is not irritating like a peanut, yet it carries infection from the mouth. In most cases peanuts are unchewed kernels, and most often in children without molar teeth with which to chew them. A young child is made very sick; an adult may not be sick at all. I recall a case, a doctor, who consulted me for a peanut that Dr. Manges very accurately located in a posterior branch of the right inferior-lobe bronchus. I asked the Doctor if he wished me to take it out, and I told him I could take it out that afternoon. "No," he said, "it is not bothering me any, and I have an appointment over the week-end in Atlantic City. I will come up from Atlantic City Monday morning and have you take it out." I found surprisingly little reaction, which I attributed to the patient being an adult. With children the reaction is inversely to the age; an infant of one year will be made extremely sick by a peanut in the lung. Any toxic or infective agent affects different individuals in varying degrees of severity. With the children in one family all equally exposed, one child will die of scarlet fever while another may have the disease so lightly one can scarcely make a diagnosis. So in the reaction to the peanut, some children are more seriously affected than others. My opinion coincides with that of the speaker in preferring tracheotomy to intubation for the edematous larynx in peanut cases. Dr. Chamberlin, however, has used intubation satisfactorily in these cases.

Dr. Harris P. Mosher, Boston, Mass.:

I wish to speak to two points made by Dr. Hubbard, namely, the need of deliberation in the performance of bronchoscopy and esophagoscopy, and flooding of the lungs rather than anaphylaxis as a cause of respiratory embarrassment after bronchoscopy.

In doing bronchoscopy too much emphasis has been put on time. The stop-watch is a dangerous thing in the hands of the beginner. It is all right for a past-master like Dr. Jackson, but it gives the rest of us a sense of hurry. In bronchoscopy preparation is just as important as deliberation in its execution. Everything possible should be worked out beforehand. The more bridges that are crossed before the operator gets to them the better.

I have a feeling that flooding of the lungs will be found, as Dr. Hubbard suggests, to play as much a part in the reaction which follows the inhalation of a peanut as the toxicity of the peanut.

Dr. John W. Murphy, Cincinnati, Ohio:

I was unfortunate in not hearing all of Dr. Hubbard's paper, as I got in a little late. From what I did hear and see of the lantern demonstration I heartily approve of the assayist's opinion. In reference to

the hook, I have not seen the hook he is using now, but in my early days I had a very unpleasant experience with the hook method. In one case my hook became fastened in the lung and I spent a few minutes of unpleasant time in extracting the same. Since then I have been very cautious in using the hook, as it has not been in my hands as successful as in Dr. Hubbard's. We have all taken most of our lessons from Dr. Jackson, and while I do not use a stop-watch, I do, as Dr. Mosher suggested, try to do the operation thoroughly before attempting it on the patient and seeing that all preparations are properly made, so that we may be deliberate and at the same time not lose time.

Dr. D. Bryson Delavan, New York:

The history of bronchoscopy reflects undying credit upon American discovery and invention. Horace Green, of New York, first discovered the fact of the tolerance of the larynx to the presence of a foreign body. Joseph O'Dwyer demonstrated that the larynx would tolerate the presence of a foreign body for an indefinite length of time. Having perfected a tube for the ordinary purposes of intubation, O'Dwyer devised a tube with very thin walls, large interior diameter and straight sides for the express purpose of introduction into the larynx in order to aid the expulsion of foreign bodies inhaled into the trachea or bronchi. Many times, at the request of Dr. O'Dwyer, the speaker had experimented with him by means of the ordinary laryngoscope in demonstrating the bifurcation of the trachea through the above-mentioned tube inserted in the larynx of a living patient. Dr. O'Dwyer had a clear idea of what he intended to do, and wrote a paper on the subject. His experiments were interrupted by his death, but not until the practicability of his invention had been amply proved by actual demonstration. A little later Edison invented the electric lamp, the endoscope was devised, and the combination of that with the O'Dwyer foreign-body tube quickly led to the bronchoscope. All who in our own country and abroad have contributed to the final brilliant result deserve credit. But the real glory belongs to Joseph O'Dwyer, the actual originator and demonstrator of the fundamental idea.

Dr. Henry L. Swain, New Haven, Conn.:

I should like to say a word in regard to diagnosis which Dr. Hubbard took up in his paper. I had occasion three days ago to straighten out a diagnosis made by the physician who referred the case to me as one of either tumor or foreign body in the larynx which he hoped that I might remove. I discovered that the diagnosis was paralysis of both

posterior cricoarytenoid muscles, giving the customary inspiratory dyspnea, and the attendant had become confused, thinking some foreign body was in the larynx.

Dr. Hubbard (closing):

I appreciate this discussion, and before answering in detail I should like to mention a fact that I omitted in the paper. In the whole group presented, bronchoscopic and esophagoscopic, there was one death—a peanut case. The peanut was removed very easily, but I did not aspirate the other lung. As a matter of fact the physician who examined the child before operation located the peanut in the left lung because there were more rales there. I took the peanut out of the right bronchus. The family physician called me up and made a daily favorable report, but he overlooked the progressive pneumonia, and when I saw the child on the fourth day, a few hours before death, the left lung, which I had not aspirated, was solid. I think that was a case in which thorough aspiration would have saved the life.

As to laryngeal conditions: The dyspnea may be chiefly spasmodic, and in such cases respiration is easier as anesthesia progresses; but one should not confuse spasmodic croup with a foreign body in the larynx or closing the glottis. I do not think that anesthesia increases the laryngitis. I am speaking of the general run of cases in which laryngeal dyspnea does not necessarily contraindicate the use of a general anesthetic. I do not think the time factor is so important. Dr. Jackson laid great stress on the danger of leaving the tube in the trachea too long. The trauma of introducing determines the post-operative edema.

If you plug a bronchus you have comparatively high negative pressure (intrapulmonary) on thoracic expansion. As soon as the negative pressure is satisfied by the transudation of fluid it can become a plus-pressure, just as Dr. Jackson says. As to arachidic bronchitis, I think that the whole question of specific toxicity and inflammation is quite settled by the fact that if you remove the fluid thoroughly enough the fever and symptoms of inflammation vanish. In such cases the fever is due to the foreign protein (retained secretions) and irritating particles of a peanut. Any foreign-body case may develop bronchopneumonia, and it is well to consider all cases liable to this serious complication, giving a cautious prognosis and careful after-treatment.

I agree with Dr. Murphy's point: One must be very cautious in the use of hooks in the lower bronchi. Therefore the shield hook, which is as large as the little finger-nail, is safe because you really cannot get it caught. The special pin forceps demonstrated by Dr. Jackson seems to be a perfectly adapted one to solve a certain mechanical problem.

# THE RADICAL FRONTAL SINUS OPERATION, WITH REPORT OF CASES

FIELDING O. LEWIS, M.D.

In a large percentage of cases in which there is a chronic suppurative process in the frontal sinus the radical operation affords the best means of a permanent relief from such distressing symptoms as recurring or persistent pain and headaches, purulent nasal and postnasal discharge, alarming vertigo, gastrointestinal lesions, and focal infections. There is a certain group of cases in which some form of radical procedure is unquestionably the only method of treatment. I would mention in this connection those cases with external fistulæ, intracranial complications, extremely large sinuses with their often-present septal divisions, bone necrosis, severe orbital complications, and when the intranasal operation has been unsuccessful.

By radical operation is meant the Killian or some of its many slight modifications. This type of operation affords the surgeon the opportunity of carrying out certain surgical principles which are essential to success in these cases. By the Killian method of approaching the sinus it is possible to visualize the entire field of operation, which is the only definite way of determining what is within the sinus. If foreign bodies are present, as in one of my cases a piece of drainage tube was removed; if bone cysts have formed, three of which were found in another case; if anatomical variations (which is the rule rather than the exception) are encountered; if the mucous membrane of the sinus is hyperplastic with its ever-present polypoid formation; if there is necrosis of the posterior plate—a thorough house-cleaning is, to my mind, clearly indicated. This cannot be accomplished by chiseling a small hole through the anterior plate any more successfully than a mastoid operation can properly be performed through a small

opening in the mastoid cortex. The intranasal operation would be about as useful as a needle puncture for the cure of chronic suppurative maxillary disease.

In my somewhat limited experience in about forty cases operated on radically a complete removal of mucous membrane, a careful examination of the septa when present, as diseased cells are often concealed at their base, and good nasal drainage are imperative in order to secure a complete cure. Careful postoperative treatment is always a feature often neglected. The case should be watched, dressed, and treated by the surgeon, or his assistant, who is fully familiar with these cases.

While some writers mention the decline in popularity of the radical operation in favor of the intranasal route, I wonder if the intranasal operation, even in suitable cases, has been all that its advocates have desired. In my own experience, with one or two exceptions, it has accomplished no more than that secured by intranasal drainage through removal of hypertrophies and septal deviations.

A postoperative deformity depends, of course, upon the size of the sinus and the amount of necrosis of the anterior plate. With such brilliant results being now obtained by plastic surgery marked deformities should be readily corrected by the transplantation of bone, cartilage, or fat. I have found that the patients, particularly those past the age of vanity, are so delighted with the cessation of the symptoms that they prefer to retain their defect, though sometimes marked, rather than to submit to what some have feared might be a return of the old trouble.

From a series of some 40 cases I have selected a few which to me have presented interesting pathological and surgical problems.

Case I.—On account of the unusual symptoms and extensive involvement of all of the sinuses this case is reported more or less in detail: W. B., male, aged fifty-four years; married; occupation, house painter for the past twenty-five years. Was admitted to the medical ward of Jefferson Hospital, December, 1921, suffering with bronchial asthma.

*Chief Complaint.* Shortness of breath.

*Family History.* Nothing of interest known.

*Personal History.* Used alcohol and tobacco moderately. Had typhoid fever in 1879 and pneumonia in 1890. Denies venereal disease.

*Present Illness.* In January, 1911, the patient had his first attack of asthma. Was engaged in inside painting when the first attack occurred, which lasted two days, and he was away from work one week. Mild attacks of short duration followed at various intervals for seven years. Three years ago he had another severe attack; since that time the asthmatic attacks have come on at irregular intervals in close sequence and at all times of the year. There seems to be no seasonal influence. For three years he has received autogenous vaccines. The vaccines exaggerated the attacks.

*Condition on Admission.* A poorly nourished adult white male. Marked gastric symptoms and breathing so difficult that he was unable to lie down.

*Physical Examination.* Eyes and ears normal. There is a large septal perforation following a submucous resection some years ago. There are nasal polypi in both ethmoidal regions and evidence of ethmoidal exenteration. Practically no nasal discharge visible. Marked evidence of oral sepsis from diseased teeth. Thorax, abdomen, and extremities negative. Urine: Faint trace of albumin, occasional hyaline and granular casts. Complete blood count shows 18,800 white cells and slight variation in size, shape, and stain of red blood cells. Sputum on numerous occasions negative for tubercle bacilli. Many Gram-positive diplococci. Gram-positive streptococci and staphylococci. Blood Wassermann negative. Patient's attacks are relieved by the administration of hypodermic injections of adrenalin chloride and nitroglycerin. Nitrate of amyl pearls and large doses of morphin were given on various occasions. Rigid diet was also instituted. While in the medical ward the progress had been very unsatisfactory. Injections of dust extractions gave no relief and the patient had often as many as six asthmatic attacks in twenty-four hours, which became more severe in character. So severe were the attacks that inhalations of ether were administered, as large doses of adrenalin chloride and half-grain doses of morphin were of no avail.

Following an examination of the nose and throat the patient was transferred to the laryngological service. Roentgen-ray studies by Dr. Manges showed considerable cloudiness of both frontal, both ethmoidal, and the maxillary sinuses.

*Operation.* December 31, 1921, under intratracheal anesthesia the right frontal sinus was first exposed by the Killian method. The

sinus was found quite large and filled with a peculiar mucoid substance. There was necrosis of the anterior plate and the septum between the frontal sinuses was necrotic. The left frontal sinus was then opened and the dura was found exposed by necrosis of the posterior plate for an area the size of a twenty-five-cent piece. Both maxillary sinuses were opened and found equally diseased, with marked necrosis of the outer wall and the nasoantral partition. The remaining ethmoidal cells were also found diseased and exenterated. The sphenoidal sinuses were also found to contain pus. From the amount of bony necrosis of the entire skull and from the character of the discharge tertiary lues was suspected. Though a negative spinal-fluid examination was found the patient was given neosalvarsan. Almost immediately following the extensive operation on all the sinuses and the administration of the neosalvarsan the patient showed marked improvement, which continued until his discharge on February 14. While he has had some attacks of asthma they have been far less severe and much less frequent.

Case II.—J. F. F., male, aged thirty-one years; married; occupation, postal clerk. Patient was seen in consultation on July 2, 1921.

*Chief Complaint.* Pain in the right frontal region. Some nasal discharge. Symptoms of constant cold and epistaxis. General health good.

*Family History.* Father died of carcinoma; mother dying of the same disease.

*Personal History.* No severe illness until the present time. One child living and well.

*Examination.* The right nostril was filled with a freely movable, hemorrhagic growth, about the size of a large white grape, attached to the middle turbinate. Bleeds freely when touched. On transillumination the sinuses were unusually clear. Roentgen-ray examination negative. Under local anesthesia the growth was removed with a portion of the middle turbinate and sent to the laboratory for examination, a report of which was given as an epithelioma, following which 50 mg. of radium were placed in the nose and cross-fired with placques on the outside. This was repeated in the course of six weeks.

Patient returned in December, 1921, with a return of the growth and suffering with intense headaches on the right side. The growth was again removed and radium introduced as before. Roentgen ray made at this time shows a normal condition of the antra on

both sides, they being clear without evidence of pathology. The sphenoidal sinuses showed clearly on each side with no increased density. The frontal sinuses are also clear.

The patient was seen again in the course of a month; the nostril was free of any evidence of growth, but the patient's headaches had increased to such an extent that he was unable to sleep or attend properly to his occupation. He had occasional attacks of vomiting. His general condition gradually grew worse and he was admitted to the Jefferson Hospital for further observation. Further roentgen-ray studies were made and the right frontal sinus was found cloudy—the other sinuses were clear. No pus could be seen in the nose. He was apathetic. Pain was so intense that morphin had little effect. Vomiting became worse with no rise of temperature. Neurological examination revealed all reflexes normal; the eye-grounds were negative as to intracranial pressure. The Wassermann was negative. Lumbar puncture showed no increased pressure and the spinal fluid was normal.

*Operation.* On account of the extreme headaches and roentgen-ray findings the right frontal sinus was opened externally by the Killian method and the sinus was found to be filled with an apparent coagulation necrosis of the mucous membrane. The material, of the consistency of gelatin, was removed *en masse*, leaving the bony wall clean and shiny. There was no evidence of any bone involvement. The sinus was treated in the usual manner. The patient's symptoms were not relieved and death occurred at the end of the first week. A bacteriological examination of the material was sterile. Postmortem examination was refused.

*Remarks.* It at once occurred to me whether it was possible for the radium to have had such an effect upon the mucous membrane of the sinus, and if so, did the radium affect the brain cells?

Case III.—A. R. H., male, married; aged forty-three years; occupation, bookkeeper. Admitted to the Jefferson Hospital, Philadelphia, September 21, 1910.

*Personal History.* Had scarlet fever and diphtheria when a child. Has had more or less discharge from his nose since childhood. Nasal polypi were removed by his family physician a month before his admission.

*Present Illness.* Chronic yellow, foul, and profuse discharge from the left nostril. For the past few weeks has had severe pain and some fever.

*Condition on Admission.* General physical examination was negative. The left eye was completely closed by a swollen upper eyelid. Extreme redness and marked tenderness. Photophobia and marked lacrimation. Examination of the nose showed both nostrils filled with nasal polypi and a mucopurulent discharge. Roentgen-ray showed involvement of the left frontal and both ethmoidal sinuses.

*Operation.* Nasal polypi were first removed under local anesthesia. The frontal sinus was then opened by the Killian method under general anesthesia. The entire anterior plate was necrotic and the sinus was filled with pus and polypoid mucous membrane. The packing was introduced with external drainage and the patient made an uneventful recovery.

Three years later the patient returned with a swelling in the same location but an absence of redness and tenderness. On reopening along the line of the former incision it was found to be a mucocele, which was thoroughly curetted, packing again introduced, and the patient has had no further trouble up to the present day.

Case IV.—Dr. W. W. W., male, married; aged thirty-three years. Admitted to Jefferson Hospital, October 15, 1921.

*Family History.* Negative.

*Personal History.* Patient had a gastroenterostomy during his college course for gastric ulcer. Has had a purulent discharge from the nose following repeated attacks of cold while a student. Both maxillary sinuses were operated on radically, also exenteration of the ethmoids on both sides.

*Present Illness.* Patient complains of severe headaches, more pronounced when the nasal discharge is scant. Attacks of loss of consciousness, which were epileptiform in character. Loss of weight and inability to practice his profession.

*Conditions on Admission.* Polyps were found in both nostrils in the region of the ethmoids. Mucopurulent discharge more pronounced in the left side. Transillumination of the sinuses shows a darkened area over the frontal region. Roentgen ray showed marked involvement of the left frontal sinus and cloudiness of the right. Blood Wassermann negative.

*Operation.* On November 15, 1921, under intratracheal anesthesia, a double Killian operation was performed. Both sinuses were extremely large and deep, with several septal divisions. In the left frontal sinus were found three bone cysts, the largest being about the size of a robin's egg. The other two were somewhat smaller.

These contained an amber-colored fluid. There was no necrosis of the posterior plate.

*Subsequent History.* When last seen a few weeks ago the patient had gained twenty pounds in weight, was attending to his daily country practice, and has had no further attacks of epileptiform seizures and no nasal or postnasal discharge.

Case V.—L. B., female, single, aged fifty-nine years. Admitted to Jefferson Hospital, January 29, 1920.

*Family History.* Negative.

*Personal History.* Some two years previous had an attack of influenza. This was followed by a purulent nasal discharge and swelling in the region of the left frontal sinus. An external opening in the frontal region was made by a surgeon and the sinus curetted. Has had a constant discharge from an external sinus in this region almost continuously with a purulent discharge from the nose.

*Present Illness.* Complains of severe headaches, discharge from an external fistula above the left eye and purulent discharge from the nose, and frequent colds.

*Examination.* Examination shows a fistula extending into the frontal sinus, some polypi, and a mucopurulent discharge in the left nostril. Roentgen-ray report shows slight cloudiness of the left ethmoid cells and to a less degree of the right. Left frontal sinus apparently obliterated by a former operation. Maxillary sinuses normal. Blood Wassermann negative. General physical examination negative.

*Operation.* Under intratracheal anesthesia the sinus was exposed along the line of the previous incision. The sinus was found to be filled with pus and granulations. The wound was packed in the usual manner.

*Subsequent History.* A few months following the operation the patient had some discharge in the region of the old fistula and marked deformity at the inner angle of the wound. Under anesthesia the fistula was again curetted and packed and the deformity corrected by a plastic operation. For the past year there has been no evidence of any discharge or further symptoms.

Case VI.—C. B., male, married; aged forty-one years. Occupation, traveling salesman. Admitted to Jefferson Hospital, March 7, 1920.

*Family History.* Negative.

*Personal History.* For the past five or six years the patient has had severe headaches which were diagnosticated and treated as migraine. Had consulted many physicians and relief could only be obtained by hypodermic administration of morphin. Blood Wassermann had been made repeatedly and always found negative. No roentgen-ray examination had ever been made up to the time of his admission.

*Condition on Admission.* No tenderness or swelling in the region of the frontal sinus could be obtained and no purulent discharge could be found in the nostrils. Transillumination showed a darkened area in the region of the right frontal sinus. Roentgen ray showed a rather large sinus and extremely cloudy. The other sinuses were apparently clear. General physical examination negative.

*Operation.* Under intratracheal anesthesia the frontal sinus was exposed in the usual manner and found to be filled with thick, creamy pus. The mucous membrane was thoroughly removed and free nasal drainage instituted. As the ethmoids did not seem to be involved they were not disturbed. The patient made an uninterrupted recovery.

*Subsequent History.* Has had no further symptoms referable to his sinus. Has had occasional headaches, but less severe than before the operation.

Case VII.—H. D. C., male, married; aged thirty-nine years. Was admitted to Jefferson Hospital, June 22, 1921.

*Family History.* Negative.

*Personal History.* For several years the patient has complained of recurrent headaches and postnasal discharge. Had consulted physicians repeatedly without relief. Right frontal sinus operated on one year ago. Discharging fistula since. Was referred by a former patient who had had a frontal sinus operation.

*Condition on Admission.* General physical examination negative. Wassermann negative. There is a discharging external fistula over the right frontal sinus, with pus in the right nostril. No polypi.

Roentgen-ray report by Dr. Manges showed marked cloudiness of the right frontal sinus. The sinus was considerably larger than the left. The other sinuses were clear.

*Operation.* Under intratracheal anesthesia the right frontal sinus was exposed by the Killian method and was found divided by four distinct septa, each compartment filled with polypoid degeneration of the mucosa and pus. Two external iodoform drains and one intranasal iodoform drain were introduced and the wound closed in the usual manner.

The patient was discharged in ten days with a cessation of all symptoms.

Case VIII.—Mrs. C. J. H., aged thirty-three years, married. Admitted to Jefferson Hospital, July 13, 1921.

*Family History.* Father died of tuberculosis.

*Personal History.* General health good until October, 1920.

*Present Illness.* Has had repeated colds since March, 1921, complicated by acute bronchitis and some symptoms of asthma. Shortly afterward had severe pains over the left supraorbital region and radiating into the eyeball. Frequent nausea and vomiting. Vertigo for the past week and spots before the eyes. Thick foul nasal and postnasal discharge.

*Condition on Admission.* Negative with the exception of the purulent nasal and postnasal discharge and hypertrophied tonsils. Wassermann negative. Temperature, pulse, and respiration negative. Urine clear. Roentgen ray by Dr. Manges: "There is marked cloudiness of the left frontal sinus, the left ethmoid, and the left maxillary antrum. The frontal sinus is rather large. There is an abscess apparently at a molar tooth, the crown of which has been destroyed, in the left upper jaw. This is rather close to the antrum."

*Operation.* Under intratracheal anesthesia the usual Killian incision was made, exposing the left frontal sinus, which was filled with foul pus and granulations. There was also partial destruction of the supraorbital ridge by necrosis. As much of the ridge was left as possible to avoid a marked deformity. The left maxillary sinus was operated on radically by the Denker method, the sinus being filled with pus and polypi. The diseased tooth, which extended into the maxillary sinus and was no doubt the cause of the infection, was extracted at the same time.

The patient was operated on July 14, 1921, and discharged July 22, 1921, with absence of all previous symptoms.

Case IX.—H. K., male, aged thirty-seven years; married. Occupation, railroad brakeman. Was admitted to Jefferson Hospital, November 10, 1921.

*Chief Complaint.* Chronic, profuse, foul nasal discharge and frontal headaches.

*Family History.* Negative.

*Personal History.* Negative.

*Present Illness.* For some months has had intermittent swelling with pain over the left eye, following an acute cold in the head.

Feeling of heaviness in the head; some slight dizziness; noises in the right ear and slight deafness.

*Condition on Admission.* Well-nourished man. Profuse purulent discharge in the left nasal chamber. General physical examination negative. Blood Wassermann negative.

*Roentgen Ray* (by Dr. Manges): "I am convinced that the patient has a left frontal sinus, although it is not quite as large as the right one. I feel that this sinus has been occluded for a long time and that there has been considerable bone thickness such as you get in a mastoid and that the natural smooth outline of the sinus is destroyed. I believe that you will want to do a radical operation, and I would advise that you make a small opening at first, because I am not certain how far down the sclerotic bone extends."

On transillumination the left maxillary sinus was found cloudy. Paracentesis revealed a large amount of foul-smelling pus.

*Operation.* Under intratracheal anesthesia the left frontal sinus was exposed in the usual manner. The sinus was found quite large contrary to the findings of the roentgen ray, and when opened a large quantity of foul-smelling pus gushed out. There was also considerable necrosis of the anterior plate. The left maxillary sinus was operated on radically by the Denker method and found to contain a large amount of pus and polypoid tissue. The patient made an uninterrupted recovery and has had no further complaint.

Case X.—L. C., white, female, aged ten years.

*Chief Complaint.* Swelling of the right eye, with pain, redness, and fever. Nasal and postnasal discharge.

*Family History.* Mother and father living. Three sisters and three brothers living and well.

*Personal History.* Had diphtheria when eight years old. Tonsils and adenoids were removed about a year and a half previous to the present illness.

*Present Illness.* The patient's mother stated that there had been a nasal and postnasal discharge, purulent in character, for several months past. Five days before the patient consulted the ophthalmological department of Jefferson Hospital a swelling was noticed, with pain about the eye. No symptoms of this character had previously been noticed. The patient was admitted to the eye department of the Jefferson Hospital, February 22, 1921. Under anesthesia the ophthalmologist made an opening into the orbit, thinking the condition was primarily an orbital infection. On introducing a

probe he found that the disease extended into the frontal sinus. The patient was then referred to the nose and throat department.

*Examination.* Well-nourished female child. The right eye was closed by swelling and marked induration of the upper eyelid. Examination of the nose showed polypi and mucopurulent discharge in the right nostril. Roentgen-ray examination reports marked involvement of the right frontal sinus and right ethmoid. Left side clear. Blood Wassermann negative.

*Operation.* March 1, 1921, under general anesthesia the usual Killian incision was made over the right frontal sinus and the sinus exposed, which was found filled with pus and granulations and the anterior plate necrotic. The ethmoids were also found diseased and were exenterated. The usual dressings were applied and the patient made a rather prolonged recovery because of a more or less persistent discharge through a fistula which developed in the incision made into the orbit. She was discharged from the hospital in May, 1921, and has had no further symptoms.

# THE DIAGNOSIS AND TREATMENT OF DISEASE OF THE NASAL ACCESSORY SINUSES IN CHILDREN

CORNELIUS G. COAKLEY, M.D.

During the last few years we have had referred to us by pediatricians an increasing number of children suffering from protracted or frequently recurring "colds in the head," with the view of determining whether these children are suffering from an infection of the paranasal sinuses. Most of these patients have had successful operations for the removal of their tonsils and adenoids. The ages of the patients we are considering vary from two to twelve years.

While the rhinologist is ordinarily able, after a complete examination of a patient, to determine very accurately whether an adult has an infection of the paranasal sinuses or not, this cannot always be so readily predicated in the case of a child. The difficulties of examination and the uncertainty of some of the tests are in indirect proportion to the age of the patient. The younger the child the more one has to consider the probability of the infection rather than be able to make a positive diagnosis.

For the better understanding of our subject a condensed description of the development of the paranasal sinuses as found in standard books and monographs is offered.

The maxillary sinuses, the frontal sinuses, and the ethmoid cells are primarily evaginations of the nasal mucous membrane developed from furrows or ridges in the superior and middle meati. The sphenoidal sinuses develop in connection with the cartilaginous nasal capsule and in a sense are primarily constrictions of the nasal mucosa from the dorsocephalic part of the nasal fossæ.

Maxillary Sinus. The maxillary sinus begins as a pouching of the mucous membrane of the floor of the lateral wall of the

ethmoidal infundibulum. At first it appears as a slit-like cavity in the membranous lateral wall of the nose. As this pouch grows there is resorption of the surrounding bone until the primitive cavity comes into relationship with the maxilla.

In the embryo the alveolar process, containing the unerupted teeth, is in proximity to the orbit. Consequently in the infant there remains but little space in the superior maxilla for the antrum. At birth the antrum is about the size and shape of a small Boston bean and occupies a space not beneath the orbit but internal to it. The cavity is never spherical but ovoid in shape, its anteroposterior measurement always being greater than its height or width. The lining membrane is thick, and because of its reduplication nearly fills the entire lumen of the cavity. The floor of the sinus is high above the nasal floor, seldom reaching below the attachment of the inferior turbinate. By the end of the first year the sinus begins to extend laterally beneath the orbit a short distance, its outer limit being marked by the position of the infraorbital canal. As the infant approaches two years of age the sinus has, as a rule, extended laterally above the rudimentary first molar teeth.

As the body of the superior maxilla increases in size, coincident with the development and eruption of teeth, there is a corresponding increase in its pneumatization, but up to the eighth year the antrum is seldom accessible for puncture through the inferior meatus. The floor of the sinus has not yet reached the level of the floor of the nose and the rudiments of the deciduous and permanent teeth are present in the maxilla in the region corresponding to the upper level of the inferior meatus. Any instrument pushed through the inferior meatus, as is commonly done in irrigating the adult cavity, will, as a rule, miss the antrum entirely and go into the soft tissues of the cheek or injure the deciduous or permanent teeth reposing in this portion of the maxilla. The same is true if one attempts to approach the antrum through the canine fossa.

From the eighth to the fifteenth year the maxillary sinus develops gradually in all directions, and by the fifteenth year may be said to have reached the adult stage.

Ethmoid Cells. The ethmoid cells are primarily extensions or evaginations of the nasal mucosa from the superior and middle meati or the accessory furrows and recesses of their lateral walls. The lateral masses of the ethmoid bone and the superior and middle turbinates (primitively solid structures) become more or less honeycombed by the developing ethmoidal cells, and while there is no uniformity of development they are classed topographically as anterior ethmoid cells and posterior ethmoid cells. The anterior groups develop from points inferior to the attachment of the middle turbinate and the posterior group from points superior to the attachment of the middle turbinate. A cell always communicates with the meatus from which it develops, the cells of each group communicate with each other, while the cells arising from unlike meati never communicate with each other.

During childhood the cells of both the anterier and the posterior group are fairly well developed. Even before the tenth year the ethmoid cells may extend into the supraorbital plate of the frontal, the body of the sphenoid, or into the infraorbital plate of the maxilla. The latter may simulate a duplicated maxillary sinus.

Frontal Sinus. The frontal sinus develops either by direct extension of the recessus frontalis of the middle meatus or from one or more of the anterior ethmoid cells. Embryologically the frontal sinus is in most instances an anterior ethmoid cell which has grown sufficiently far into the frontal region to be topographically a frontal sinus. It does not make its appearance in the frontal bone, as a rule, until the end of the first year or the beginning of the third year, but genetically it is present at birth.

By the end of the twentieth month the frontal sinus has begun to extend into the horizontal portion of the frontal bone between the tables of the vertical portion by the simultaneous growth of the sinus and resorption of the cancellous bone. During this perioid the sinus is nearer the inner than the outer plates, so that the dorsal wall is composed of rather thin compact bone while the vertical plate consists of relatively thick diploic bone.

By the end of the third year the cupola of the sinus is above the level of the nasion. From this time on there is a gradual increase in one diameter or another, varying greatly in different individuals. The frontals commonly develop asymmetrically

and in some cases never invade far into the vertical portion but grow extensively into the horizontal portion of the frontal bone over the orbit.

Sphenoidal Sinus. The fetal sphenoidal sinus is, in a sense, a constricted portion of the nasal fossa, no portion of which in fetal life is contained within the sphenoidal bone. Even up to the third year the sphenoidal sinus continues to be nasal in position rather than sphenoidal. During the fourth year resorption of the intervening nasal capsule begins together with a fusion of the inferior portion with the ethmoid bone and the body of the sphenoid bone. This forms the primitive sphenoidal sinus, which gradually grows into and pneumatizes the sphenoidal bone. In its early growth into the body of the sphenoid bone the sinus tends to develop into the dorsolateral plane to a greater degree than in the ventrodorsal plane. Thus as early as the fourth year the dorsolateral aspect of the sphenoidal sinus may come into close relationship with the ophthalmic and maxillary nerves and by the sixth or seventh year in relation with the Vidian canal. As puberty is approached the recesses of the sinus may come into relation with the ophthalmic, oculomotor, trochlear, and abducens nerves as well as the cavernous. The sinuses commonly vary to an unusual degree in both shape and size.

Those who have radiographed children and whose clinical and operative experience in treating severe cases of orbital cellulitis in children, consecutive to infection of the ethmoid, frontal, or maxillary sinuses, cannot help but be impressed with the fact that there is often a most precocious development of one or more of these sinuses in individual cases. On the other hand we recognize in other cases a very great retardation in the development of one or more sinuses, which lack of development may persist into adult life as best seen in the absence of one or both frontal sinuses.

My experience in paranasal sinusitis of children has led me to divide them into three groups according to age:

Group 1. Those between the ages of eight and twelve.

Group 2. Those between the ages of five and eight.

Group 3. Those under five years of age.

The justification for this classification may be found partly

in the stage of development to which the sinuses have arrived at these ages, partly by the certainty with which one may make the diagnosis and partly by the treatment required in each group to effect a cure.

The complete examination of a child for suspected paranasal sinusitis often cannot be completed at a single sitting. The nervous child dreads the very sight of instruments and is apt to resent their use. By tact and patience on the part of the examiner and by proceeding with the examination a little at a time we find it possible at a second or third visit to examine those in groups 1 and 2 as satisfactory as we do our adult cases. In group 3 we can seldom make what we consider a complete examination owing to undeveloped nasal cavities.

For a complete examination of the sinuses our procedure is as follows:

(*a*) Anterior rhinoscopy.

(*b*) Posterior rhinoscopy.

(*c*) Anterior rhinoscopy after contracting and anesthetizing the nasal mucosa with a weak solution of cocain, 1 per cent, and adrenalin, 1 to 20,000.

(*d*) Posterior rhinoscopy as in (*c*).

(*e*) Transillumination of the frontal and maxillary sinuses.

(*f*) Inspection of each naris in the inferior meatus, middle meatus, and the posterior nares with the nasopharyngoscope.

(*g*) Radiographs of the sinuses, anteroposterior and transverse views.

*Group* 1. *Children between Eight and Twelve Years Old.* In group 1 each of these procedures may usually be readily carried out and from the composite results a very accurate diagnosis can usually be made. I am well aware that transillumination of the eight, nine, and ten-year-old is not apt to be too reliable or as valuable as in the eleven year and twelve-year-old child, so too much importance is not given to the lack of illumination in the frontal and maxillary regions of the cases of eight, nine, or ten years. Radiographs of the sinuses in this group are very helpful. The maxillary cavities by this time are sufficiently pneumatized to show clearly when not diseased. The anteroposterior view of the frontals, however, if apparently cloudy,

must in part be judged by their depth. If deep and cloudy they are diseased, but if shallow and cloudy they may not be diseased.

For confirmation of the other evidences of paranasal sinusitis we rely greatly upon the use of the nasopharyngoscope. With the nasal mucosa anesthetized and contracted with the cocain adrenalin spray there is often too much secretion in the nose for the use of this instrument. The removal of this excess secretion cannot be done by douching or irrigation, as the bubbles of air that are formed in the middle and superior meati and in the nasopharynx prevent one from viewing the orifices of the several paranasal cavities. We suck out all of the visible secretion within the nose and nasopharynx by means of a small metal tube carried into the naris and back to the nasopharynx. The end of the tube is directed to wherever secretion is visible, be it the inferior, the middle, or the superior meatus. The pharyngoscope is gently but quickly passed along the floor of the naris until the distal end touches the posterior pharyngeal wall. With the lens vertical in this position one may see the anterior surface of the sphenoid, note the degree of inflammation or edema in the region of the ostium sphenoidale, and in cases of infection of this sinus usually see a small, thread-like, white or slightly yellow streak of discharge coming through the ostium. Failing to see such discharge at a single examination does not prove that the sphenoid is not infected, for we have many times not seen a discharge at the first visit only to find it at a subsequent one.

If we withdraw the pharyngoscope slightly and rotate it outwards 45 degrees we bring into view the posterior end of the inferior turbinate. If there is a discharge coming from the maxillary, anterior ethmoid, or frontal sinus there can be seen a collection of secretion as a streak in the angle of attachment of the posterior end of the inferior turbinate with the lateral wall of the nose. The problem is to differentiate the source of this secretion. Withdraw the pharyngoscope and place it under the anterior end of the middle turbinate. In some children with well-developed nares the ostium maxillare can be seen and secretion nearly or quite filling it. If the space in the undeveloped naris does not permit one to see the region of the ostium we must rely for differential diagnosis upon the help obtained from the radiographs and transillumination.

*Group 2. Children between Five and Eight Years Old.* The same routine of examination is carried out in this group as in group 1.

Posterior rhinoscopy is apt to be difficult or in the younger ones impossible.

Transillumination is most unreliable in these cases. The frontals scarcely illuminate at all except in cases of unusual development. Transillumination of the maxillary sinuses is generally poor and unreliable, owing to the fact that the developing and unerupted teeth give an even darkness under the orbit. If one side does show somewhat darker than the other, one never knows whether it is due to an infected antrum or to a lesser degree of pneumatization of the antrum in the stage of development.

Radiographs are of some help, but here, too, great care must be used in reading the plate to differentiate between disease and underdevelopment.

The pharyngoscope comes to our aid in finding the secretion at the upper border of the posterior end of the inferior turbinate. The pharyngoscope can rarely be used in the middle meatus in this group, owing to lack of space in the small nares at this age.

*Group 3. Children under Five Years of Age.* In this class we are practically confined to such knowledge of the sinuses as may be gained by radiographs. The reading of some plates of this group by radiographers who have no opportunity of checking up the clinical picture with the appearances of the plate often leads to very wrong interpretation. My own opinion is that many of these young children with profuse thick nasal discharges, and frequently recurring attacks of them, do have their immature sinuses infected.

Treatment. In group 1 the treatment recommended is precisely that which one would use for similar conditions in the adult. If an antrum cannot be induced to drain satisfactorily by keeping the nasal mucosa contracted a trocar can be introduced under the inferior turbinate and the cavity washed out. We find it usually requires less time and fewer irrigations to accomplish a cure in children than in adults.

In group 2, owing to the size and position of the antrum and the small frontals, irrigation of these cavities is seldom advisable.

Daily contraction of the nasal mucosa with cocain and adrenalin and irrigation of the nose with a warm saline solution may be relied on to effect a cure.

In group 3 only irrigations, as in group 2, are usually necessary.

One of the most important prophylactic measures against recurring paranasal sinusitis is the establishment, as far as possible, of adequate nasal respiration. The swollen edematous nasal mucous membrane mechanically blocks the outlets for the secretion from the various paranasal cavities. The thorough removal of tonsils and adenoids is obvious. Whether the operation should be performed during an acute attack or in the interval between attacks must be considered in each case. We prefer, if possible, to operate in the interval, but occasional cases are seen when no progress of the sinus disease can be made until these hindrances to adequate respiration are excised. We find those children with narrow nares and deflected and thickened septa the most difficult to give proper nasal respiration and drainage.

A residence for those who can afford it in a warm, dry climate and a continuous outdoor life may be necessary in some cases to restore the chronically infected mucous membrane lining the paranasal sinuses to normal.

# EXTRADURAL ABSCESS COMPLICATING FRONTAL SINUSITIS: REPORT OF A CASE

ROSS HALL SKILLERN, M.D.

This case occurred in a young man of eighteen years, who on September 30, went into a swimming pool, dove frequently, and on the following day had considerable discharge from the nose, bilateral, otherwise O.K. This continued for several days. He then went swimming again with more diving. The following morning headache was present and he was generally sick, confined to bed late in the afternoon, restless night, fever $102\frac{1}{2}°$. The next morning he was worse, headache frontal, with a considerable thick yellowish discharge from the nose, and fever.

The following day, October 5, the third day after the last swim, the upper right eyelid began to swell, with the other symptoms progressively worse. The same evening a probe was passed into the right frontal sinus, through the nose, which was followed by some relief to the headache, but the swelling on the lid and over the right forehead became even more marked. The following morning suction was used and a considerable amount of pus was brought down, followed by gradual relief from pain, although tenderness and swelling remained. Next day, pain still absent, suction was again applied, with success as far as obtaining pus was concerned, but tenderness and swelling became more pronounced. Suction every two hours during the night.

The eye had become entirely closed on account of swelling and that over the forehead was greatly augmented, but still no headache; tenderness and fever remained well marked. He was taken to the hospital and ointment was applied to the eye and forehead, and suction was continued once daily.

His condition was about the same for four days, when the forehead was lanced followed by the evacuation of two ounces of pus.

Swelling and tenderness were relieved in the forehead but not in the eye. Suction treatment was continued. One week later the upper eyelid was incised and a considerable quantity of pus evacuated. Swelling and tenderness were not relieved. Both fistulas continued active up to the time the patient was brought to Philadelphia (about ten days). In the meanwhile tenderness over the eye and the forehead almost disappeared, but swelling remained over the eye, but over the forehead it was considerably diminished.

An examination disclosed no apparent swelling over the supraorbital region. Some proptosis of the upper lid of the right side, with discharging fistula about in the center. A second fistula directly over the middle of the eyebrow, also in an active state

of discharge, was noted. Considerable tenderness on pressure but no apparent loss in the continuity of the anterior sinus wall was apparent.

*Roentgen-ray Examination.* Right frontal sinus opaque, outer wall appears to be broken up. Right ethmoidal region solidly opaque. (See skiagraph.)

Considering these findings an immediate operation was, of course, decided upon, which was performed the following day, November 2.

*Operation.* After the usual curved incision through the eyebrow and down over the ascending process of the superior maxilla, on elevating the periosteum over the frontal sinus a loose sequester of bone was noted and removed, thus exposing the sinus cavity, which was filled not only with pus but detritus composed of granulation tissue and some particles of bone. The entire anterior wall was then removed. Bleeding was very free and required considerable sponging and pressure in order to make it possible to proceed with the operation. It was then observed that the posterior sinus wall instead of being firm and unyielding appeared to give way under pressure and pus would constantly ooze up after being sponged away.

Further examination disclosed a large defect in this wall, ovoid in shape, about the size of a five-cent piece, at the bottom of which lay the exposed dura. The dura itself in the center was covered with a false membrane and surrounded with granulation tissue, and from the upper portion purulent secretion was constantly escaping. On inserting a director upward between the dura and the bone a sudden gush of pus covered the field, which proved to be a large extradural abscess with two ramifications, one almost in the median line and the other to the temporal side, each extending superiorly about one and a half to two inches. The posterior bony wall (which was badly necrosed) was then removed from below upward, over the body of the abscess, and finally over the prolongations until the limits were accessible to the probe. All necrotic bone was removed and the edges curetted, the inferior sinus wall resected, and as no evidence was present that the subdural structures were involved, the operation was completed as usual.

Iodoform gauze strips (one inch seamed) were inserted into the abscess cavity between the bone and the dura, the whole cavity packed with iodoform gauze, and the wound was allowed to remain open with the exception of the inferior portion alongside of the nose, which was closed with four sutures. The operation lasted a little over one hour, the patient leaving the table in good

condition; pulse 102, temperature 98°. The following day he appeared considerably shocked, was apathetic, and lay very quiet; pulse 120 to 130; temperature $100\frac{3}{5}°$ to 102°.

The next day (second after operation) the wound was dressed, the iodoform gauze packing partially renewed, and fresh gauze inserted. His general condition was much improved, although he was very weak.

A bacteriological report of the culture from the brain pus showed Staphylococcus pyogenes aureus in pure culture. The dressings were changed every second day and healthy granulations began appearing in the depths of the wound.

On November 18, under nitrous-oxide-oxygen anesthesia, the outer half of the wound was closed by four stitches of fine silkworm gut, and the cavity, which had greatly decreased in size and partially filled with healthy granulation tissue, was again packed with iodoform gauze.

The second closure was made on November 23 and two stitches from the first closure removed, as they had become infected.

On November 28 it was noted that several of the stitches from the second closure had cut out, so three new ones were inserted and the patient was discharged from the hospital, just four weeks from his admittance.

The formation of an extradural abscess is due to an especially virulent infection quickly ulcerating through the mucosa and attacking the bone, and is further shown by the rapid appearance of fistulas. The posterior wall, composed entirely of compact bone, offers more resistance to the infecting organism (streptococcus or pneumococcus), but ultimately succumbs, thus laying bare the dura. This structure shows great resistance to infection and endeavors to throw a plastic wall around the purulent process by forming adhesions between the dura and the bone. It depends largely upon the type of the infecting organism whether this will be successful or whether the infection will continue to spread and ultimately pierce the dura and infect the meninges and brain.

If the primary organism (streptococcus or pneumococcus) survive the probabilities are that the infective process will become widespread, resulting in death. Whereas should the primary

infecting germs become choked out by a secondary infection (Staphylococcus pyogenes aureus) the pathological activities will tend to localize themselves within certain limits or at least show a tendency to spread very slowly, thus permitting well-directed surgical intervention, coupled with rational after-treatment, to bring about resolution of the parts with complete recovery of the patient.

Frequency. Gerber,[1] in 1909, was able to collect but 28 cases of extradural abscess which were unaccompanied by any other form of cranial infection. However three of these were complicated by subdural and frontal-lobe abscess and the records of eleven others difficult of access on account of having been personal communications or published as theses.

Some repetition also seems to have occurred, as 4 cases are credited to Laurens. In addition to these I can add 8 more.[2 3 4 5 6 7] It would seem curious that frontal-lobe abscess occurs much more frequently if one can judge from the literature (Boenninghaus[8] reports 82 cases), as it is nearly always combined either with extradural abscess or some form of meningitis; but this can be explained if we consider the extradural abscess, not as the terminal stadium of the infection but rather as an intermediate process which if not arrested by nature, or surgical intervention will penetrate the dura and progress to the formation of a subdural and eventually frontal-lobe abscess or general meningitis, as the case may be.

Extradural abscess occurs much more frequently as a complication of acute frontal sinusitis than of chronic. This can probably be explained by the fact that if a patient has suffered for a long time with an uncomplicated case of frontal sinusitis his system builds up a certain general resistance to the infecting organism which, while not sufficient in itself to throw off the infection entirely, nevertheless is able to hold it in check as far as further spreading is concerned. An acute exacerbation can upset this equilibrium with all its liabilities of contiguous inflammation.

The symptoms are more often insidious, so that signs may fail entirely and the lesion incidentally found during the sinus operation which hitherto had been entirely unsuspected. This circumstance

has been noted and commented upon by several authors,[5] [9] and obtained in my own case. Perhaps one of the most significant symptoms is the sudden appearance of swelling in the upper eyelid during the course of a frontal sinusitis, as it is rarely seen with uncomplicated cases and is practically pathognomonic for a rupture in one or more of the walls.

The headache is of little diagnostic value, as it may be conspicuous or entirely absent. If, however, it continues in severity out of all proportion to the apparent pathological condition and then suddenly ceases, it is very significant that a rupture has taken place through one of the walls with sudden cessation of the secretory pressure. The condition of the pulse also cannot be taken as a criterion. Pressure symptoms apparently do not occur.

The sudden onset of a chill during the course of a frontal sinusitis followed by high fever (104° to 105°) is an unfavorable omen and can be taken for an extension of the infection, either by progress upward between the dura and bone, by perforation of the dura, or the development of a septic thrombophlebitis (rare).[10] If the rise of temperature is accompanied by vertigo, bilious vomiting, rigidity of the neck, and somnolence the onset of meningitis or an encephalitis (brain abscess) has made its appearance.[8] Convulsions of a severe type have been known to be caused by irritation of the frontal lobe.[11]

Pathology. The infection in intracranial complications may spread in the following manner.

1. Per continuity.
2. Through the bone (canaliculi).
3. Through blood and lymph passages.
4. Through dehiscences, causing the following pathological sequence:

(*a*) Pachymeningitis externa (circumscript).
(*b*) Extradural abscess (circumscript).
(*c*) Pachymeningitis interna.
(*d*) Intradural or subdural abscess.
(*e*) Leptomeningitis (diffuse).
(*f*) Encephalitis (brain abscess, frontal lobe).
(*g*) Thrombophlebitis (sinus thrombosis).

These can in no wise be considered separate and distinct pathological processes but rather a continuation of the infection, provided it has not been arrested at one of the stages by natural (resistance of the organism) or artificial (surgical intervention) means.

As far as the pathological process for the intracranial infection is concerned, it would appear as though spreading by continuity, together with the perforating veins, play the most important role. In this way the perforation of the bone is caused by the pressure of the secretion on the mucosa, thus furthering ulceration and necrosis of the periosteum. The vena perforantes carry the infection through to the meningeal side, setting up a periostitis at that point. The bone thus being deprived of its nutrition on both sides a localized solution of continuity occurs, resulting in a necrosis, followed by sequester formation. The osteomyelitis with softening may extend around the venous passages for some distance.

Paunz[12] believes that an extradural abscess forms when the underlying bone becomes slowly infected, thus permitting adhesions between the dura and bone. My case does not bear this assertion out, and I believe the virulence of the organism exercises great influence upon the subsequent course of the infection. If the original infecting germ (streptococcus or pneumococcus) continues to thrive in pure culture, not becoming attenuated, the case will probably go on to general meningitis and death, whereas if a secondary organism (staphylococcus) finds entrance and chokes out the original causative factor the chances are much better that the infection will tend to localize itself, thus becoming amenable to treatment and saving the life of the patient. This fortunately is not a rare occurrence, as it has been shown that the staphylococcus is present in complicated cases of frontal sinusitis twice as often as the streptococcus.[13]

I cannot entirely agree with Dreyfuss[14] when he states that if a perforation of the posterior wall is found the chances are one to two that a brain abscess is present, but I can endorse his statement that extradural abscess is more frequently found in widespread necrosis (infection of the diploë) than in simple perforation of the posterior wall.

Treatment. Drainage is the absolute essential factor in order to bring one of these cases to a successful conclusion. This can best be accomplished by iodoform gauze and a wide-open wound. As these extradural abscesses are usually unsuspected and found by chance during the sinus operation, we must always be ready to deal with one should that eventuality arise. Fistula formation in the upper lid or the supraorbital space should invariably be looked upon with the greatest suspicion. Necrosis of the posterior wall is practically always accompanied by a circumscribed leptomeningitis, or, if the purulent stage has been reached, by an extradural abscess. When this is found the posterior wall must be removed until the limits of the abscess are freely accessible to the iodoform gauze packing. Most authorities insist upon the removal of the bone until it is flush with the limits of the abscess cavity. This is not necessary and certainly not indicated, particularly after the superior limits of the sinus cavity have been reached, for after the posterior wall has been resected to its upper limits further resection will only bring the scalp into juxtaposition with the dura, which will shut off the dural space more completely than the hard, unyielding wall of the frontal bone, not to mention the permanent defect to the bony covering of the brain which follows.

When indications point to the presence of dural involvement the posterior wall should be opened where it appears suspicious and the dura freely exposed. If it is discolored, nonpulsating, or covered with granulations or false membrane, pus should be sought for by introducing a probe between the dura and the bone in various directions. When the abscess has been found (which usually occurs immediately if present) the limits are carefully sought for by the probe, as one must be careful not to break down any adhesions which may be forming between the inner table and the dura to wall off and localize the collection of pus from the general meningeal cavity. The posterior wall is then carefully resected with the heavy bone forceps, usually in an upward direction, until the limits of the abscess cavity can be reached. Seamed iodoform gauze strips are packed loosely between the bone and the dura, and after the inferior wall of the sinus has been removed and a large counteropening made into the nose the entire cavity

is packed with iodoform gauze and only that part of the incision alongside of the nose closed. The outer dressings are changed in twenty-four hours, as they become saturated with blood, which dries and becomes very stiff and uncomfortable. The internal dressing is changed on the second day, but the gauze strips between the bone and dura are left undisturbed. Dressings are subsequently changed every two days until the sinus cavity begins to become filled with healthy granulation tissue, when the gauze strips can be removed (about one week after the operation). Partial closure of the wound can now be made with silkworm-gut sutures, but a loose packing should be still kept in the sinus. After a week or so this packing can be discontinued and the entire wound closed, provided good drainage has been established with the nose.

If the symptoms do not subside or an augmentation of the same takes place within forty-eight hours after the operation the wound should be opened to ascertain if by chance a damming back of the secretion has occurred. If not the dura should be immediately incised and the frontal lobe explored for the possibility of a brain abscess. Freudenthal[15] reports a case that four days after a radical frontal, on account of continuation and exacerbation of symptoms, the wound was again opened and the dura incised, which was followed by the escape of 100 grams of pus. Complete recovery followed in six weeks.

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## Discussion on the Papers of Drs. Lewis, Coakley and Skillern

Dr. J. H. Bryan, Washington, D. C.:

I agree with Dr. Lewis in everything he says in regard to the need for radical operation in these severe sinus cases. In regard to the Killian method, I am perfectly frank to say that I do not do it. I have seen Dr. Killian operate and I have seen his after-results, which are very disfiguring. We are operating on Americans; a great many of them are women, and they certainly do not want to be disfigured as the Germans disfigure their German women. I want to say to Dr. Lewis, while I agree with everything he says, I do not like the cosmetic effects; there is too much depression and too much scarring, and I believe that can be corrected by not taking away so much of the anterior wall. It is not necessary except in extensive necrosis of the anterior wall to remove the whole wall. Here is the anterior wall of the frontal sinus. I make a large section of that wall, leaving a bridge

between the lower end of the resected bone and the ridge. In that way if you will take away an extensive section and not remove the entire wall you will not get the depression, and I think that is the secret of getting a perfectly normal external appearance after these operations. I exenterate the ethmoid bone completely all the way back to the sphenoid. In the old methods we formerly used I had to operate once or twice: the whole difficulty was that reinfection took place from the ethmoid cells. When you lay open the whole side and also lay open the orbital wall you can remove the ethmoid bone all the way back, including the sphenoid. The suture of this wound is important. I coapt the edges as carefully as I can and take ten to fifteen sutures, more if necessary, to bring the edges together perfectly. Those who have seen the after-results of my cases can testify there is almost an impossibility of determining whether that patient has had an external operation. In regard to the complications of the frontal sinus such as Dr. Skillern described, I reported at the Boston meeting an interesting case of extradural abscess that was a streptococcus hemolyticus infection, and it was very difficult to determine whether there was an extradural abscess or abscess in the anterior lobe of the cerebrum. The probe passed through a traumatic opening that was made near the lower internal angle of the posterior wall of the frontal. Infection took place through that opening and a probe passed well up, and it seemed as if it had gone into the anterior lobe. I injected nitrate of thorium and the demarcation of this extradural abscess was perfect; a probe then passed through the fistula showed just where the whole condition was. Nitrate of thorium is better than bismuth and brought out delineations perfectly. I reported this at the Boston meeting. This patient had to have several severe operations and I made extensive resection of the frontal bone; an abscess was found in the upper part and communicating with a thick sinus wall leading down to this opening. That patient got along splendidly and was sent home as cured; in the course of forty-eight hours he was sent back, an infection had taken place, and he died of a subdural abscess along the lower portion of the cerebrum.

Dr. Lewis A. Coffin, New York:

I can pick out a number of men here who would like to discuss this subject for half an hour. I agree emphatically with Dr. Lewis. There are cases which will recover only from radical operation, and further, I agree as to his radical technic. I cannot agree with Dr. Bryan. The technic which he has shown might prove successful in a certain

proportion of cases coming to operation, but in cases of multiple cavities or with large supraorbital recesses it cannot succeed.

As to Dr. Coakley's paper I have only time to express my surprise at his surprise at the manner in which, in one case reported, the scabs disappeared and the turbinates took on such a better look after opening and cleaning the antra. Some of us have been harping on this for some time.

Dr. Francis P. Emerson, Boston, Mass.:

I should speak of one point without detriment to the other valuable papers, as I feel indebted to Dr. Coakley for calling attention to sinus involvement in young children. During my last hospital service all children under ten years of age admitted to the wards for a postaural abscess had their sinuses roentgen-rayed as well as the temporal bone. This was done as a routine without any regard to whether there were clinical symptoms in the nasopharynx or not. Out of 30 cases under ten years of age, 80 per cent of them showed roentgen-ray pathology in the antrum, 2 suppurative ethmoiditis and maxillary sinus disease, and 2 had pansinusitis on the side of the affected ear. Whether this pathology is as general as these cases seem to show I do not know.

Dr. James E. Logan, Kansas City, Mo.:

I regard Dr. Coakley's paper as a very valuable contribution to the literature of sinus conditions in children. He has exhibited great patience and perseverance in evolving some method of treatment. His closing statement relative to the last case reported was particularly interesting to me, namely, the character and location of the mucous incrustation in the nose make me believe that the pathology of atropic rhinitis might find explanation in previously existing sinusitis in childhood. In a paper on "Atrophic Rhinitis," read before this Association in 1900, I attempted to prove the correctness of this theory. I have never had reason to change my mind.

Dr. Lee Wallace Dean, Iowa City, Iowa:

I wish to emphasize the importance of nutritional therapy in the management of cases of paranasal sinus disease in infants and young children. Regardless of the apparent condition of the baby or young child, so far as its nutrition is concerned, we have found it to be of decided advantage to have not only the pediatrist, but an authority on nutrition assist in the treatment of this class of cases. I should like to report an experiment which has been made at the University

of Iowa which has some bearing on this subject. I am going to ask you not to assume that the result secured is at all definite, but it has given me food for thought, and I hope it will be of some interest to you. Dr. Daniels, in the metabolic department, fed about twenty-five to thirty white rats, with the expectation of trying to produce, by feeding, xeroderma pigmentosa. She fed these rats on the following: 18 per cent casein, purified; lard, 10 per cent; salt mixture, 7 per cent; cornstarch, 65 per cent. As the result of these feeding experiments typical xeroderma pigmentosa was produced, and Dr. Daniels asked me if she might have the services of the head specialty pathologist to work out the pathological findings. The rats were sent over to our laboratory and Dr. Armstrong found that in every rat there was an extensive suppurative pansinusitis. White rats that had been fed on a diet poor in calcium and phosphorus, the rachitic rats, had no sinus disease. I am not reporting this with the intention of stating that the absence of any vitamine will produce a tendency to paranasal sinus disease. I mention it simply because of its interest in connection with nutrition and paranasal sinus disease.

We had a woman in the obstetrical service with maxillary sinus infection caused by hemolytic streptococci; she gave birth to an infant, and the infant, when ten days old, developed nasal discharge, and the hemolytic streptococcus was present in the discharge. Nasal irrigation, suction, argyrol, etc., were used. The infant developed a suppurative mastoid. We operated and the ear became well. At the age of about seven weeks the infant died. It was autopsied by Dr. Armstrong assisted by Dr. Medlar. In the paranasal sinuses much pus was found. Dr. Armstrong and Dr. Medlar expressed the opinion that the cause of death in this infant was a suppurative paranasal sinus disease which persisted in spite of our very best treatment.

Dr. John M. Ingersoll, Cleveland, Ohio:

I should like to emphasize the point Dr. Coakley brought out in regard to the interpretation of roentgen-ray pictures by the surgeon instead of by the radiologist. I think this is very important. Studying the radiographs of the anterior posterior and lateral views helps very much in determining the conditions in the sinuses. The knowledge that we get in that way plus the knowledge obtained in the clinical examination is a very material help in these cases. Then, too, the knowledge gained in regard to the size and shape of sinuses helps in determining what should be done in an operative way.

Dr. Otto T. Freer, Chicago, Ill.:

The chief objection to the Killian frontal sinus operation is the partial removal of the roof of the orbit as far as it forms the floor of the frontal sinus. To uncover so sacred a cavity as the orbit merely to stuff one of no physiological importance, the frontal sinus, with orbital fat, in order to lessen deformity, seems to me an unwarrantable trespass upon the integrity of the eye, for the pulley of the superior oblique muscle is liable to detachment with resulting lasting diplopia. I know of two instances in which this happened. One of the patients permanently wore a patch over his left eye, the left frontal sinus having been operated upon, because the double vision was so distressing that he was worse off than if the eye had become blind. Although the operation had been done many months before I saw him there was no improvement in the diplopia.

Why is chronic suppuration of the frontal sinus often so intractable even after the utmost possible intranasal drainage has been obtained by the intranasal operation, while chronic suppuration of the maxillary antrum disappears so readily after adequate ventilation and drainage are obtained after a free resection of the nasal wall? The chief reason is that in the case of the frontal sinus the narrowness of the intranasal surgical approach, due to its dangerous limitations by the inner orbital wall and the front end of the olfactory groove, make it impossible to open the sinus outlet enough to give the ventilation and drainage required even when the internal nasal crest is well removed with the bur. In addition the operation leaves a long outlet with walls of denuded bone, so that the healing stage produces abundant granulations that soon block the opening made. On account of these conditions the frontal sinus becomes the equivalent of an inverted bottle with a narrow neck filled with a thick fluid, which in the case of the frontal sinus is pus retained in the sinus cavity because of atmospheric pressure, which would be released were through drainage established from the brow through the sinus into the nose. By doing this the favorable conditions that make the intranasal maxillary sinus operation so successful are established for the frontal sinus. By following this reasoning and maintaining long-continued drainage by means of a rubber drain passed from the brow through the sinus into the nasal cavity I have so far always succeeded in ending the suppuration, the forehead opening being permitted to close after the drainage has been kept up for a month or two. This experience has shown me that the prevalent theory, that hopeless degeneration of the mucous membrane lining of the maxillary and frontal sinuses is the usual

sequel of chronic suppuration, is not founded upon fact. Only rarely is it necessary to curette away the lining of the frontal sinus because destroyed by granulations. It is this supposed inability of the mucous lining of the frontal sinus to recover that led to the creation of the radical frontal sinus operation with the excessive deformity that follows where the sinus is very large.

I operate as follows: After opening the sinus from below by resection of the anterior one-half of the middle turbinated body, free removal of the anterior ethmoid cells and cutting away of the internal nasal crest with the bur as described in an article on the intranasal opening of the frontal sinus published by me in the *Transactions of the American Laryngological Association* some years ago, an incision is made along the inner two-thirds of the eyebrow and carried down upon the frontal process of the superior maxillary bone and the sinus opened close to its ostium just above the sinus floor by means of a knife-edged cutting bur driven by a dental engine with a cable (Doriot) handpiece. The opening is enlarged with the Cozzolini punch, buttons of bone being cut out until the opening will permit a good view down into the sinus and freely permit the passage of a No. 12 English rubber drain down into the nasal cavity, the opening into which has been enlarged from above by cutting away remnants of the internal nasal crest from above with a barrel-shaped straight bur. The deformity after the operation is slight or nothing. Granulation gradually ceases until a smooth straight canal is finally seen leading into the nasal interior, or else the restored and healthy lining of the frontal sinus is seen.

Dr. Vilray P. Blair, St. Louis, Mo.:

I naturally have some temerity in discussing this subject before this body, but I am sometimes let in on some of the troubles you have. Dr. Ellis Fischel and I have had three cases of extradural abscess, following frontal-sinus suppuration, on two of which we have operated. One was a child, five years of age, on whom a simple incision, high up in the forehead, was made; a sequestrum was removed, inferior drainage established and recovery followed.

About June 28, 1921, Dr. Sauer had a boy come to him with pain and swelling above the right brow; he did a radical frontal sinus operation, removing the anterior wall of the sinus along with the lining mucosa and also a part of the vertical part of the frontal bone. Later the boy returned with an extension of the epidural abscess farther back toward the coronal suture, and Dr. Sauer asked us to take charge

of the case. He then had an epidural abscess, about 5 cm. in diameter, covered by necrotic "worm-eaten" bone through which the pus had penetrated, causing also a superficial collection. Through a midline incision the area was exposed by dissecting the scalp laterally; the dead bone was removed; the granulations were stained with methylene blue to identify their limits and bone was rongeured away in all directions until healthy dura was exposed, except for a short distance on the right side, where there was a white layer, which looked like fibrin about 1 mm. thick, separating the dura from bone. The bony defect was already very large, and this fibrin looked so innocent that its ultimate limit was not exposed. This proved to have been a mistake, for an extension of the bone necrosis occurred at this site, and when it was later uncovered this fibrin layer was found to have broken down and the underlying dura was covered with granulations over which the bone was necrotic. After each of these operations perforated tubes were placed along the edges of the bone defect and frequent irrigations with carbromin solution were made in an attempt to limit the extension of the necrosis. The boy was sent home, and while *en route* received a severe accidental blow on the left side of the head, and he later returned to us with a broad extension of the necrosis on the side of the injury. As it is very poor surgery to make a wide removal of the convexity of a parietal eminence, drainage was instituted by repeated incisions and burred holes through the bone. During this period the fibrin layer and its gradual breaking down with concurrent necrosis of the bone was repeatedly observed. In this area the fibrin layer was not confined to the epidural space, but in places occupied the space between the scalp and bone, and then the bone necrosis would start in the outer table and extend toward the inner. There were certain things, both in the character of the necrosis and in the white fibrin deposit, that suggested syphilis. In April of this year, in spite of the repeated negative Wassermann reactions, he was put on mercury. Following this, whether *post hoc* or *propter hoc*, there seemed to be a clean-cut limitation of the necrosis and spontaneous separation of the dead bone. The case is still draining. While under our care there have been five drainage or bone operations and five blood transfusions.

In reviewing the case three pertinent questions arise conspicuously out of the mass of conflicting impressions gained. The first relates to the nature of the pus infection. It was surmised that it was a streptococcus, and once such a culture was obtained; all the others showed staphylococcus, but I believe that a streptococcus is one of the under-

lying factors. Secondly, is syphilis also a contributing factor? In the syphilitic a necrosis of the jaw bone that successively involves larger areas may follow a pus infection, and this may be much aggravated by surgical interference. The clinical course of this case presented many points that reminded me of a luetic jaw necrosis, and it was apparently improved on mercury. Third, was the subsequent limitation of the necrosis in any way due to the fact that about this time it had reached sutures in all directions? If the normal suture tends to form a barrier to the spread of the destructive process its crossing of the coronal suture in this case might be related to operation or to the blow on the head already noted.

If I were to encounter another such case in the stage at which this came to me I would establish drainage where needed. I would attempt to find the pertinent pus organism, with the view of making an autogenous vaccine, and would also give mild antiluetic treatment. Only after these attempts to build up the tissue resistance would I again attempt to limit the spread of the necrosis by operation. The plan of this would be to surround the whole of the diseased area by a furrow ploughed in the healthy bone as a farmer protects his stackyard from fire, and treat this furrow by antiseptic packing or irrigations in the hope that by the time the destructive process reached the furrow it would encounter an effectively resistant wall of granulations.

I feel like apologizing for this long talk, based on a clinical series of one case, but this case has elicited from me a great deal of thought and speculation.

Dr. Emil Mayer, New York:

This splendid demonstration of Dr. Coakley's, showing so clearly the area of accessory sinus disease in children, recalls to my mind the fact that some years ago when some of us had the temerity to say that accessory sinus disease in children did occur, it was followed by a learned dissertation by a German colleague to the effect that there was no such thing, that it was an osteomyelitis; they were tubercular foci. The presentation of this morning and former papers by our fellow-members, Dr. Coffin and Dr. Dean, are ample proof that accessory sinus disease in children does occur.

Dr. J. Payson Clark, Boston, Mass.:

In Dr. Lewis's final remarks I should like him to state whether the cases have been free from purulent discharge following the operation?

Dr. Samuel McCullagh, New York.

I should like to call attention to an apparatus for the treatment of nasal disease in children which I have been using with success for the last year or so. I have probably had about one hundred cases in which the adenoids and tonsils had been removed and were not responsible for the condition.

This apparatus, devised by Dr. John M. Loré, of New York, combines suction and irrigation. The nose-piece is a modification of the Lucae ear douche. A piece of small rubber tubing, which projects about one-quarter inch beyond the glass part, is attached to the inner end of the inflow tube of the Lucae device. A piece of rubber tubing leading to the receptacle containing the wash fluid is attached to the outer end of this inflow tube. A second piece of tubing is attached to the outflow tube of the Lucae device and leads to an air-tight bottle in which a vacuum can be produced.

The receptacle containing the wash fluid is below the level of the patient's head and the tip of the nose-piece is inserted in one nostril, the other closed and the patient instructed to repeat the letter "K." At the same time suction is started. This draws the wash fluid from its receptacle through the nose and into the bottle, where the washed-out material may be inspected. Dry suction can be obtained by removing the end of the inflow tube from the solution and pinching it.

Suction can be induced by an electric or water pump. The latter is merely pushed over the faucet and the degree of suction obtained is regulated by the rate of flow.

The whole apparatus can be put in the hands of the patient for about five dollars, and so is available for the home treatment of all these cases at frequent intervals. The great advantage of this apparatus is that positive pressure is never present in the nose, and in an experience with several hundred patients, young and old, no case of infection of the middle ear has occurred.

In my experience it has proved the most valuable adjunct in the treatment of sinus diseases in children.

Dr. Cornelius G. Coakley, New York:

May I be permitted to say a word in discussion on the other papers? It seems to me that the photographs exhibited by Dr. Lewis of the majority of his cases are most admirable. They do away with some of the recent criticisms, it seems to me, of the Killian operation, namely, that it is not a successful operation. If the Killian operation is not a successful operation it has not been done properly.

It is our fortune (or misfortune) to see at Bellevue Hospital unsuccessful cases that have been supposed to have had a Killian operation done at one or another place. They come in with fistulæ, and none of them have been thoroughly and adequately done. When the Killian operation is rightly done there is no recurrence of infection in that frontal sinus. I think most of the cases shown by Dr. Lewis had a certain amount of puckering in the scar, which I believe can be overcome with a modified type of incision. Killian's cases showed this and my earlier ones showed them. Since 1907 I have modified the incision, and since that time the scarring in the line of incision has been very much improved. The skin toilet is made with soap and water, followed by alcohol. No iodin is used.

The eyebrow is not shaved. The frontal incision is begun at and just above the inner end of the eyebrow and continues outward parallel to the eyebrow and above it to the external angular process. It can be stitched up evenly. The trouble with the Killian incision is that it does not stitch evenly. You cannot shave an eyebrow and have it come in regularly and symmetrically with the other side. The second or ethmoid incision is begun just below the supraorbital notch and continues downward midway between the inner canthus and the dorsum of the nose to the lower end of the nasal bone. The Killian incision always puckers at this site and you will get a much better result cosmetically by separating the incisions than by the Killian. I agree with Dr. Lewis that if by intranasal treatment you cannot secure relief from sinusitis then the more thoroughly you open up your frontal as advocated by Killian, with removal of the entire anterior wall, the better results you will get.

One word about mucoceles: I do not believe he had a mucocele. In some way his technic was faulty. He left a bit of mucous membrane in there until infection and hypersecretion resulted; the connective tissue closed off the nasal drainage and secretion accumulated in the frontal sinus, a so-called mucocele. I have had one myself and I have seen those of others, and in every case I believe it has been due to some fault in technic. As to the superior oblique, the man who knows how to operate will not have any interference with the superior oblique. If you cut through the muscle you will have interference with the action of the superior oblique, and perhaps permanent diplopia; but if you lift up the pulley of the superior oblique as you operate from above or below there will not be a particle of diplopia, except a slight one for a few days.

As to extradural abscess, it is to be regarded as a most serious com-

plication. We have found them in three or four cases, and while we have refrained from opening into the brain at the time, not caring to go through an infected area with the possibility of there not being an abscess of the frontal lobe, yet later on three of these cases developed a cerebral abscess, which they probably had at the time of operation, and later died.

Dr. Norval H. Pierce, Chicago, Ill.:

I was not going to say anything about the Killian operation until Dr. Coakley said, "Whenever you perform a Killian perfectly and thoroughly you will never have a recurrence." Some months ago I operated on a man on whom Killian himself had operated eighteen years before. He came to me with pain, and upper eyelid and frontal region swollen. I could not get a probe into the frontal sinus after very careful search. I went through the original incision through the eyebrow and found the frontal sinus a small cavity, the larger part of which had been obliterated. I again tried to get into the nose with a probe from above and failed. In other words, here was a case Killian himself had operated on, eighteen years ago, where the drainage channel from the frontal sinus had been entirely obliterated.

A case that I will very briefly report of cerebral abscess of the frontal lobe following acute frontal sinusitis is very interesting: A young woman, in the early twenties, had come into a hospital ten or eleven days before I saw her. She was under the treatment of another specialist who had diagnosed acute frontal sinusitis. He had gone out of town and left the case in charge of another man. On his return he found a temperature of 103° and she had considerable headache. I saw her immediately after he had seen her and found she had a markedly stiff neck, Babinski and Kernig. The spinal fluid was taken shortly after this and found to be clear; a skiagraph taken at this time showed a cloudy frontal sinus. I gave a very unfavorable prognosis. A radical Killian frontal operation was decided on. Now in these grave cases the extent of the incision and deformity should play a really secondary importance. The main thing is to find out the extent of the disease and remove it if possible. This young woman was an exceedingly good-looking young woman. I took away the entire anterior wall of a very large sinus. I could not get up to the median and upper portions of the temporal bone, and at this portion there was softening. In order to further explore this thoroughly I should have had to make an incision directly up in the median line to within a few centimeters of the hair line and reflect that flap, and here is where my

heart got the better of my scientific judgment. I did not do it. To my great surprise the symptoms of meningitis decreased after this operation. The other specialist carried on the after-care of the case. About a week afterward I was called in to look at the patient and found a fluctuation point over the area that I knew was softened—that is, in the median line about one and a half inches above the glabella. I thought this was one of those cases of osteomyelitis, so I made a small incision. Less than a dram of pus escaped. I did not hear anything more about the case until three weeks afterward. The course had been this: The drainage through the nose was perfect, a good big opening through which the doctor could get a catheter to the frontal sinus. The external wound had healed up; the temperature was normal; the spinal puncture in the meantime, which had been recommended by another physician, showed normal fluid: the pulse was normal; the patient had gained in weight somewhat; the only thing that aroused any suspicion of an intercranial trouble was that the disposition of the patient had changed: she was irritable, she was getting up at nights apparently without any purpose and trying to wander out of the room. Talking over this with her brother, I found that this was simply an accentuation of a headstrong, excitable disposition that she apparently possessed by nature. At this time it was suggested that we send her home. A neurologist was called in and advised keeping her under observation for a few days and sending her out for automobile rides. She went on an automobile ride and came back and vomited; headache occurred; temperature rose; and spinal puncture was normal. At this time I noticed that there was still fluctuation above the glabella. The incision, however, had healed. She was put on the operating table and we abandoned our esthetic sense and made a free incision from the hair line to the eyebrow and turned back the flap. This was followed by a gush of pus. Then we found there had been a perforation of the bone at the point of softening before referred to. This was enlarged down to the frontal sinus, and about one inch downward and outward from the perforation in the frontal bone was a fistula through the dura which led into a frontal lobe abscess that contained at the time two ounces of pus that we could collect by sponging. That is, we had an abscess of a silent area of the brain, with normal temperature, normal cerebrospinal fluid, normal pulse, no focal symptom, normal fundi, in fact with no symptoms other than a slight accentuation of the normal mental peculiarities of the patient and malaise. The patient recovered.

Dr. Lewis (closing):

Dr. Coakley and Dr. Coffin have expressed my views relative to what Dr. Bryan has said. It is my feeling that if the sinus is large and has accessory cavities one must remove every vestige of disease to cure the patient. This cannot be accomplished through a small external opening except where the sinus is extremely small. There has been no permanent diplopia in any of the cases. There has been transitory diplopia in a few of the cases.

Answering Dr. Clark: As far as I know the cases have been free of discharge following the operation. Relative to the incision described by Dr. Coakley, I would state that I have tried it in a few cases but felt that it did not give sufficient room to resect the whole orbital wall, which is so often essential.

Dr. Coakley (closing):

There was no odor to the discharge, but I have every reason to believe that there might have been later. As far as nutrition is concerned, practically all the cases are under the expert care of pediatrists of the city.

# MODERN COMMENTARIES ON GALEN, THE ORGANS OF RESPIRATION AND THE VOICE AND THEIR PHYSIOLOGY

JONATHAN WRIGHT, M.D.

The fundamental vice of theory common to every age in the evolution of scientific thought, but most glaringly exhibited in the anatomical conceptions of antiquity, is in making it the master instead of the servant of the mind. In anatomy the ancients formed an idea of what the structure should be to account for or serve for some physiological function badly understood and itself not attentively studied, and then despite the continual obtrusion of anatomical facts upon their attention they ignored them or actually distorted them in the interest of their theories. The internal thoracic anatomy had to conform to the idea that the inspired air, the pneuma, the vital element, the food of life as it still remains, supplies man not with physical energy alone as we now know it, not alone to cool and moisten the blood, as was prominent also in ancient thought and to which we still may not be unwilling to subscribe, but it supplies him with intellectual and moral faculties as well, the gift of the gods, which were carried with the blood to the heart, thus forming a link of the pantheistic or world soul with the human soul. I will not say that in every thinker's mind it was thus so simply and confidently formulated as I have boldly stated it here for the sake of brevity, but essentially this was the trend of ancient cosmic philosophy and of ancient religious thought, very much more closely affiliated then than now. It would be loss of time to show that there had existed ever since Alcmaeon, some six hundred or seven hundred years before Christ, a better physiological theory than this; but it suffices to say this was the prevailing conception of respiratory function, and it is perfectly easy to show how much truth we can extract

from it by its liberal interpretation, but from this I must also abstain. The air and the blood in the lungs underwent mutual modifications which prepared them for the heart, the seat of thought and emotion, and in fact the center of life, protected from injury by the soft substance of the lungs around it, so that it could not bruise itself as it kicked against the ribs. This was the thought not alone of Aeschylus but much later of Aristotle, the greatest scientist of antiquity as Plato was the greatest thinker. The elasticity of the lungs helped it to rebound and added vigor and elasticity to its action. This latter was a conception Plato in the Timaeus (70. *C*) furnished to Galen of the heart and lungs, surrounded as they are with strong membranes also protecting them.

Daremberg,[1] in a footnote, copies a story from Hoffmann and Bauhinus, which is sufficiently amusing, as to a dispute two anatomists, who were earnest students of Galen three or four hundred years ago, had with one another while in attendance on a German princeling as to the position of the heart. In the absence of human dissection, Galen had to depend for much of his anatomy on experience with dissection of animals, and reasoning from them to man he places the heart too near the center of the thorax,[5] following Aristotle,[2] who claims for it this position of honor as the center of life and thought and, in consonance with the theory above, central and upward rather than downward, forward rather than back, though elsewhere[3] he gives its sheer to the left correctly and Galen follows him here again.[4] In this confusion of authorities the seventeenth century disputants, who had as yet not done much dissection themselves of any kind, went astray. The Duke of Baden had palpitation of the heart and his medical counsellor called in two wise men of Heidelberg as consultants. As a result the barber was summoned to put a blister over the heart, and he put it over the center of the chest. The prince angrily scolded him for his ignorance and the barber called on the doctor. The latter, being questioned by the irate patient as to the position of the heart, declared it was in the center of the chest. Still more excited His Highness called for the Heidelbergers. One of them came and said the heart was to the left, whereupon the prince dismissed his attending physician with

contumely. The latter rebuked the consultant for his treachery. The dispute waxing warm and coming to the prince's ears the consultant had to make his assertion good by opening the thorax of a pig and showing the prince the situation of affairs. After a great deal of discussion among the profession whom the bold consultant opposed on the authority of the autopsy, while most upheld the teachings of the ancients a petition was made to the prince and he took back his medical attendant, but at a reduced salary. Even three hundred years after the dissection of the human body had begun we thus see the persistence of the blight of Aristotle's theory. The heart ought to be at the center of things, and if dissection shows it is not, so much the worse for human dissection.

Galen is much impressed by the way the thoracic organs, and particularly the heart, are protected not only from external blows and jars but from the functional movements of each other. The lungs enfold the heart with five lobes as fingers would surrounding it in the hollow of the hand;—lining the thoracic walls like a veritable air cushion is the idea. He dwells on its tough, fibrous structure. Despite the fact he rejects finally and forever the idea the heart is the origin of the nerves, one argument hitherto having been based on the idea the membranes around it are nervous in character, he nevertheless feels the atmosphere created by this conception, which Aristotle had adopted from earlier anatomists. The former center of life had to be protected, as we would say, out of deference to public sentiment, and Galen exhibits this feeling when he partially accepts the view that the heart, being surrounded, we may suppose, by so many safeguards, is never itself attacked by disease. He modifies this a little by saying "hardly ever." Nevertheless the description Galen gives of the anatomy of the heart surpasses anything by far that Aristotle has left or any other author whom we know of before the time of Galen, especially anyone of whose work we have even fragments; but for all that, from Galen himself, from the fact that he does not vaunt his own knowledge of the vascular system to the skies, as he does his achievements in the matter of the recurrent nerves and the functions of the spinal nerves, from our knowledge of the character of the man, we infer he is detailing to us much which

was the knowledge of his epoch when he talks of the heart and lungs and the blood current and of the respiration.

In his manual for dissection (*De anatomicis administrationibus*, as Kühn calls it), the themes of which, according to our ideas, should be entirely objective, undisturbed by any thought except of what can be seen, we find them continually subjected to teleological considerations. The *Utility of the Parts*, one of his other treatises, with which we are here chiefly concerned, is constantly in his mind. The size of the animal does not determine whether the heart has three cavities or not (the right auricle in Galen's anatomy belongs not to the heart but to the pulmonary vein), it was the air intake and the voice production settled all that. It was a first consideration with him not what he actually saw but what he should see to prove that "nature here, as in all other matters, does nothing in vain; everything is of some use."[7] In his striving thus to understand her and to refute Aristotle he missed after all the significance of the cardiac ventricles and auricles and the way leading to a suggestion of the mechanism of the circulation; but it is very difficult indeed for the modern student to perceive just what picture he formed in his mind of the course of the blood current in the heart and lungs and the general circulation, and one becomes often hopelessly confused with his veno-arterial and his arteriovenous terms for vessels and their tunics. The arteries holding air had thicker coats to make them air-tight; blood being thicker could travel by itself in the veins along thin-walled tubes without danger of leakage, and the veins not being stiff they could insinuate themselves better into various localities where they are found. Among the marvels of the providence of God, for Galen found in the ancient religion a basis for his teleology, in the mechanism of the thorax there was a power in the lung itself to contract independent of, yet consentaneous with, thoracic contraction. This was the reason the pulmonary artery and veins had soft walls so that they might fill and be emptied by thoracic and pulmonary impulse, but the other veins in which food was prepared it was better to have unchanged so that the blood content should be constant. The body is nourished by them, the tissues drawing the blood through their tunics to themselves by their inherent power of attraction. Notwithstanding his

frequent revolt from him, the entelechy of Aristotle had to interfere every other thing to get Galen out of a hole.

The pulmonary veins need not supply much nourishment to the lungs as they need but little, hence their wall tunics are denser but yet not so dense that some of the more attenuated air and such part of the nourishment as was in the form of vapor sufficient for the scanty nutritional needs of the lungs might escape through them, not, of course, the thick and sedimentary part of the blood such as nourishes the liver.[8] All we can say in favor of this way of mind working is that the perpetual need for pores through which the contents of the vessels can escape doubtless played its part in all we have learned in regard to the biophysics and biochemistry of the tunics of the vessel in the last two thousand years, and in all fairness to Galen and in the face of all the scientific methods now cherished that must not be forgotten, for after all absolute objectiveness in the workings of the human mind is a mere myth. It is curious to see how close such methods could take Galen, fifteen hundred years before the microscope came into use, "In the whole body there is a mutual anastomosis of minute mouths and openings in both the arteries and the veins, and these let pass both blood and air from one to the other through certain invisible and narrow channels."[6]

For the Galenic circulation as well as for the Harveian we see the capillaries, though not found, had to be imagined. These acted, it seems, not only as communicating channels between artery and vein but the whole as a sort of reservoir for the blood when it surged out of the thorax on expiration, causing a compression of the thoracic veins. The channels by which the blood is expelled from the heart are arteries in the modern usage. In the Galenic usage our pulmonary artery was a vein because of its structure and because it was supposed to nourish the lungs. We call the vessels that pour blood into the heart veins, but for the ancients the pulmonary vein was an artery because it carried air from the lungs to the heart, Erasistratus thought without and Galen thought with blood accompanying the air, even though its walls are those of a vein. The heart-beat was not due to contraction in our sense, but the impulse felt both in the heart and the systemic arteries was due to the throb of the pneuma; the

air that had been taken and elaborated in the lungs and delivered to the heart or a part of it was the vital force usually identified with the soul of man, thus in direct continuity with the soul of the world.

"The number of the ventricles of the heart is not the same in all animals, for in those which inspire the air through the pharynx, through the nose and the mouth, immediately following on these is the lung and the right ventricle of the heart; but for the remainder there is neither any lung nor any size to the right side of the heart, for these two things necessarily are intimately dependent on the lungs—the voice of the animal and the right side of the heart."[7] This is not exactly following the Latin translation of the Greek text of Kühn nor the French translation of Daremberg, but this rendering seems to me called for despite the disconcerting absence of mention of the larynx. "The right ventricle is made for the sake of the lung; the lung itself is the instrument of respiration and of the voice." To be sure he is only intent on showing that Aristotle was wrong to make the number of cardiac ventricles depend on the size of the animal, yet it is singular that Galen, who elsewhere in this same book elucidates the anatomy of the larynx, in a way he claims originality for in clarion tones, and of which to tell the truth he had a right to be proud in his day, it is singular, I say, that he makes no mention of either larynx or trachea or bronchi here where he specifically refers to the voice.

The need of the heart valves is felt, and this so obviously they could scarcely escape observation; but the prepossession of the mind with the idea that the chief propulsive power acting on the blood current is the contracting thorax is so great that they, and of course their physiological action, receive a confused though detailed description.[9] A very interesting chapter is the history of the development of our knowledge of the portal circulation, but this we must pass over with the remark that though it was allowed in antiquity that the arteries took their start from the heart, the veins were said to arise from the liver. Galen even made the pulmonary veins proceed from the heart to the lungs, though he knew the blood current was in the other direction; but he has a rather hard time accounting for his inconsistency in the course of which he ridicules Asclepiades[10] and criticizes

Erasistratus for saying the structures varied because of the air one carried, that is the aorta, and the blood the other carried, that is the pulmonary veins, though we have just seen him saying very much the same thing himself. In fact our knowledge of the very important work of Erasistratus in anatomy is very much confused, even the little we have, by the hostility of Galen, by far the most fertile source of our knowledge of it, due chiefly to the opposition Erasistratus headed, with very vulnerable arguments, against the practice of venesection. We know, however, that Erasistratus's idea was that what we call blood-vessels of the lungs communicate directly with the air channels and draw from them the air which, thus going to the heart, is distributed through the aorta and the bloodvessels to the general system. The root of the word aorta in Greek we might be disposed to seek for in that of air, but that does not seem possible. Nevertheless it was a word originally applied to bronchial structures, and in the oldest Greek writers may be found thus used, Aristotle first identifying it solely with the vessel which now is its only application, but it is interesting to know that the name came to it from the air channels of the lungs. It is not the place here to try again, as I have in a number of essays endeavored to do elsewhere, to show how attractive and plausible the pneumatic theory, which captivated Aristotle and Erasistratus and many of the other best minds of antiquity, was. Suffice it to say we have largely replaced the pneuma, materialists as we are, with the matter-of-fact oxygen which is derived from the air through the lungs and goes along everywhere with the blood to refresh and strengthen the bodies of the vast majority of living things.

Incomplete and superficial as is this reference to the physiological and anatomical conceptions of Galen in regard to the thoracic contents, we must now follow him upward in his understanding of the air passages and the specific instrument of the voice. But before we leave the lung one more quotation will reveal the difficulty Galen had with the anatomy of Erasistratus, in one respect at least. Galen was sure and could prove it by experiment that the peripheral arteries contained blood, but he could not entirely cut loose from the theory of the pneuma; indeed, who can even today? He could not get away from the

pressing conviction of antiquity that there was something in arterial blood which did more than give it a redder color. The pneuma must be there and evidently in the lung something did happen to the blood, and Galen, no more than Aristotle, could not make out where the air tube left off and the blood tube began. Egyptian anatomy formed a tradition both for Aristotle and for Erasistratus; they were coterminous and there was no blood in the arteries. No more than the Egyptians or Aristotle or Erasistratus did Galen know anything about the diffusion of gases, exosmosis and endosmosis, and differentials of absorption. Doubtless they had all seen capillary attraction but knew not the capillaries. They had to go back to Empedocles for the conception of attraction and repulsion, and for two thousand years it has clung as a support to his simile of love and hate, as though that explained anything, for who can account for antipathies?

"Why, I cannot tell,
But I do not love thee, Dr. Fell."

Ah indeed, and who after all can tell what attraction and repulsion is even outside of the tender passion? But not to wander further from the subject, Galen[11] remarks that behind where the glands project into the cavity of the thorax the windpipe "is there divided and proceeds to all parts of the lung with the vessels which come from the heart distributed to all its lobes"—this is the Aristotelian anatomy. They must run side by side, that is what makes it so hard to see they are coterminous, is probably the thought of Aristotle, for he goes it blind finally and says, "The trachea is also united with the great vein and with the part called the aorta." Galen insists "It is only in the lungs the tube is entirely free of blood." Occasionally a little vaporous blood is seen in it, "but the aspera arteria is entirely free of blood when the animal is normal." It must be confessed with the old Egyptain tradition weighing one down here was a difficulty indeed, the blight of theory.

No doubt it was with a sigh of relief Galen leads away from the subject upward to our territory: "Why is not the windpipe all of it cartilaginous or all membranous by nature, but alter-

nately cartilage and membrane? Why are not the cartilages themselves perfect rings, but each lacks some small portion of it? With this I shall busy myself. First of all, it is the function of the cartilage to act as a vocal instrument.[12] . . It is not every stroke of the air that is able to produce a vocal sound, but there has to be a certain symmetry and arrangement of the vibrating substance, and of its resistance also, whereby the air meets with more or less prolonged opposition, so that it does not collapse, its resistance being overcome." This resistance Galen subsequently explains is furnished by the muscular closure of the glottis. Now when Galen begins to talk about the vibration of the trachea in voice production we know at once he is on the right track, of course, but that he is going to miss the significance of the vocal cords when he comes to the larynx. He knows all about the waves of sound from the old Greek nature philosophers, as when you throw a stone into a duck pond, so in the ear by the incidence of the air is produced the sound. Alcmaeon knew what it was and its effect when it struck like the plectrum of a bell on the hollow bones of the ear, some seven hundred years before Galen was born perhaps. Galen knew something had to vibrate, but in going up the air tube from his troubles in the lungs he was a little premature and found the wrong thing doing the chief instead of the lesser "vibrating," and he gets into fresh trouble. "The cartilage in animals," he says, "assumes this symmetry in such a way that when less resistant than they are ordinarily, through their laxity, they set the air itself more gently in vibration; when more firm they easily cause it to rebound, so that it does not spread out nor resist the impulse received, but is cast upward and flows out in a manner similar to a current rather than to a gust, and thus exhibits the effect of its energy." There is nothing very wrong about this except he has set the wrong structure to do all the vibrating.

Much more correctly even than is found ordinarily in modern text-books he nevertheless overstresses the part the trachea plays in voice production, its lengthening and shortening, its dilatation and contraction. We have also been led astray by the interest the complicated laryngeal mechanism has aroused in our minds to neglect the part played by the tube below the rima glottidis. The carti-

lages of the tube—resonant, flexible, elastic—engaged the attention of Galen more than muscles and ligaments in voice production, "Its cartilages are the instruments of the voice itself, the bands that bind them together those of respiration. Moreover that it is the cartilage is the prime instrument of the voice, the larynx is especially a document of proof to thee; that I have already shown in my book on the voice is the chief, as it is the first one, and that it is unnecessary it should be all one cartilage is apparent to anyone. . . . The trachea first assembles the sound and prepares it for the larynx, and the palate, like a kind of gong or reverberator, resists the voice, and the uvula, like a clapper, swells it. Not simply in expiration* is the voice formed, but yet the blowing of the air is the real substance of the voice, and in its way of working it differs from expiration in breathing, although the muscles of the thorax cause that too. That has its own method of action and so especially does the voice." He again speaks of the trachea and declares it is the immovable state of its cartilages has to do with voice production and it is their motion has to do with respiration. We find here the palate and uvula referred to, but in Cicero we get the idea that the teeth take the place of cords in string instruments producing sound.[16]

This resonance idea we see prominent in the way he treats of hoarseness—destroy the cartilage and it supervenes at once, despite the soft parts are left intact. He does not primarily say, cut the ligaments or muscles and the voice is lost. It is a framework matter chiefly for him. It is the differentiation in the relative prominence of the ancient thought as contrasted with the modern to which I wish to draw your attention, and then I want to show how much that depends on the ideas that run underground through the minds of men who have no or only the remotest connection with medical thought in general. We are always failing to realize how much we depend on humanity in the mass for our opinions and we are continually laying the flattering unction to our souls that we direct and do not follow popular currents. Galen no more forgets the moving and

* I make my own interpretation of this part of the Greek text, as that of neither Kühn nor Daremberg is here very satisfactory, but I imagine it is the thought as well as the language of Galen which is here obfuscated.

movable laryngeal parts than we entirely neglect the resonant parts of the organ of voice which lie below the glottis. When an outsider, when Garcia showed us the workings of the vocal cords, we fell into line with a tendency, which overshot the mark.

But in the days of the ancients the importance given to the length of the trachea pervaded the lay mind and we find it formulated in the resonant lines of their poets. The swan sang its death notes and imagination made them sweet, imagination pure and simple, as anyone can testify who has ever heard a swan squawk. Such an one will ever remain unconvinced their notes are melodious in the article of death. For Homer the cranes, which flee from the coming winter and sudden rain, fly with clamor toward the streams of the ocean. (*Iliad*, iii, 5.) The magnificent lines of Virgil* have been translated by Glover with scarcely less splendor:

> "Like snow-white swans in liquid air,
> When homeward from their food they fare,
> And far and wide melodious notes
> Come rippling from their slender throats,
> While the broad stream and Asia's fen
> Reverberate to the sound again."

Now all this was because swans and cranes had long tracheæ, and Galen, referring to Hippocrates's description of the voice in certain morbidly dry states as clangorous, repeats the line in Homer I have referred to and says, "Thus it is in all animals who have long necks and dry cartilages, of which kind are the cranes." I do not know what his opinion was of the singing notes of the giraffe, which Caesar first showed at Rome in his triumphal games.

I should perform a tiresome service were I to point out how much less of the ligaments and nerves and muscles of the larynx Galen knew than we do, and I am poorly adapted to such anatomical criticism, owing to my far-flung and deep extending ignorance of modern anatomy, and I flatter myself I am performing better

* Ceu quondam nivei liquida inter flumina cycni,
Cum sese a pastu referrent et longa canoros
Dant per colla modos; sonat amnis et Asia longe
Pulsa palus.—*Æneid*, vii, 699–702.

service and a more interesting one in thus laying emphasis upon some of the causes of the variation of much in the Galenic physiology and anatomy from our own. This I take it is a part of that psychology in the history of thought which it is absolutely necessary for the future historian of science to lay bare before us. It can only be a trifle in a special field such as ours, but it will serve in illustration, and it is neither useless for us to mark it nor is it entirely devoid of casual interest to go beyond the special field in trace of it, though the teleological bias is there also sufficiently obtrusive. The tracheal tube is not only long and therefore must be superior in sound production, but the tracheal cartilages are hard, oval, and arched in front to act as bulwarks to external violence and spanned behind by soft resilient contractile bands to allow deglutition to take place without disturbing the essential parts of the vocal function of the trachea, which for Galen bulks so large in voice production, so all wise, so skilful is the Creator of all things, for we must not forget that Galen, like most successful practitioners, was a pious man. How else could God have made it better? Did Epicurus and Asclepiades think they could have made a better job of it? This great book of Galen on the *Utility of the Parts*, he declares, is largely written to demonstrate the wisdom and glory of God, and with this statement we get another line on the psychology and the mentality and the methods of thought of the author.

The anatomy of the larynx as set forth in the works of Galen doubtless represents an advance over that of his predecessors. When we come to that part[13] of it dealing with the cricoarytenoid and cricothyroid articulations the translation of Daremberg departs so widely from the text and translation of Kühn that we must surmise a fuller text was at the service of the former than Kühn used. Even the latter does some violence to the text he furnishes, which results in a stretching of the knowledge of Galen at this point. The text as I read it says the two cartilages, the thyroid and the cricoid, quite evidently articulate with one another aslant or obliquely, but Kühn translates it (dearticulantur autem et committuntur inter se partibus obliquis) "with oblique parts," which may mean oblique surfaces or oblique fibers of the cricothyroid muscle, but does not surely mean one or the other as it

stands in the text. Daremberg, however, says, "They articulate one with the other upon the side by an arthroidea by means of the small horn of the thyroid and the articular apophysis of the cricoid." (Ils s'articulent l'un et l'autre sur le côté par arthrodi au moyen de, etc.) Now I am not a paleographer and I would not enter into this discrepancy were it not that it seems as though, if Galen had in his mind as sharply defined as the translation of Daremberg indicates the anatomical relationship of the parts, he would be on the track to a knowledge of the physiology of the vocal cords as we understand them and even the latitude of Kühn's rendering suggests the same. It is true the text here is not very satisfactory, for as it goes on to the arytenoid joint it defines the articular surface as convex at the point "where the cricoid leaves off." Daremberg intercalates certain words in brackets which do not exist in Kühn's Greek text of Galen, but which are to be supposed to represent Daremberg's conception of the meaning of the passage, and so far as the warrant of the Kühn edition goes he transgresses still more seriously by not including still others of his rendering in brackets. The result is—when the reader compares the two translations, the Latin of Kühn and the French of Daremberg, with one another and then compares them each with Kühn's Greek text—confusion reigns.

As I have said, I am no paleographer and I am not much of an anatomist, but I cannot help wishing someone combining the two qualifications would treat the various texts of Galen at this point, if at no other, as the importance of it in the history of laryngeal anatomy demands. Then Kühn's text and translation passes on to speak of the cricoarytenoid joint. On the cricoid "there lie two small convexities. Here, therefore, begins the third cartilage." Galen's number for the laryngeal cartilages was three, the arytenoid being a single cartilage with two articular surfaces at its base. "The third cartilage having cavities exactly fitting the latter eminences so that the meeting of these two cartilages (the cricoid and the united arytenoids) makes a double joint." Now this mistaken conception of Galen himself is perfectly clear, and with those surfaces before his eyes or in his mind, with the arytenoids forming a single cartilage, there should have been for him no sliding joint, and no swinging joint either. No

lateral folds of the mucous membrane, even if he made out the tendinous structures within, could have had any significance for him. His book on the voice has been lost and we do not know how far he went in the anatomical and physiological description of the parts; but we have every reason to infer, with this fundamental error of observation, he could not have grasped the nature of intralaryngeal movements, yet he says, evidently referring to the lost treatise, "How first the voice may be formed in the larynx, how the latter is most dilated and compressed, opened and closed exactly above its orifice is shown in other writings." Kühn's translation is not very happy here either, but the necessary emendations, which a laryngologist can supply, are not great and do no violence to the text. His conception of opening and closing the larynx is essentially a purse-string mechanism,[14] and this seems all the more remarkable because his knowledge of the internal and external musculature and the membranous and tendinous structure was surprisingly extensive if not very accurate; but I have no intention of going into details. It is moved by twelve muscles proper to its structure, my notes on this part of his discourse say, and, so far as it has relation with neighboring parts, by eight others. In animals with a loud voice he seems to think the arrangement if not the number differ a little, but after all he cannot get away from the pneuma. That the animal should produce a voice the air must be set in motion with something more than a simple expiratory sigh, but at the same time the glottis must be made narrower and wider in the passage of the air through the larynx, and in this act the muscles of the chest in the first instance and those of the larynx in the second place must be brought into play. However I must leave Galen's struggles with the mechanism pure and simple of the larynx and pass to his great claim to our respect—his demonstration of the recurrent nerves.

The fourteenth chapter of the seventh book of the *Utility of the Parts* marks a great epoch in the history of our knowledge of laryngeal physiology,[15] and one is infinitely amused to see how well Galen knew it and how his vanity swelled, burst, and ran over into loud jubilations of self-laudation. It is long drawn out and I cannot translate it all; it was too sweet a morsel for Galen

to abbreviate, and we must perform that painful task for him here:

"Everyone will marvel if he will but lend his mind to what I have to say here. . . . You must show yourselves more attentive than if you were taking your initiation at the Eleusinian or Samothracian mysteries or at any other great solemn ceremony of the kind, so great because of those things which are done and said by the priests. You will stand in wonder and think this is nothing inferior to those sacred things nor less indicative of the power, wisdom, foresight, and goodness of the Creator. Listen then to me, for I am the first of all to discover these sacred things. No one before me has perceived any of these nerves nor any of these things which I have found in the larynx as before described, their cause and their action. The anatomists have all erred and they have not touched upon a tenth part of them. Turn, therefore, if thou hast been lax before, and now at least be an attentive and worthy listener to what is about to be disclosed; follow my discourse setting forth the marvelous mysteries of nature."

The nerves in the time of Galen were not yet fully differentiated from the membranous and tendinous structures which on superficial examination they resemble. It is not altogether clear how much he had to do with this movement, which probably was well under way when he began his studies. We find him seriously imbued still with the idea they have some mechanical action like a string on the muscles in which they end, an affinity still and sometimes a confusion with the tendinous parts of muscles at their insertion. As the recurrents curve around the great vessels this notion especially took possession of him, as though thereby on the principle of the pulley they have a drag downward. Their oblique course, he thinks, saves them from the strain of the direct pull. In this connection he reminds the reader, nevertheless, of their origin in the brain or its prolongation and that they do not come primarily from the heart, the center of all things Aristotelian. All the muscles receive the nerve in their heads or near it, at least above the middle of the body. If in the center, as of the diaphragm, all fibers draw toward the center. "This is common to all muscles, and divisions (of the nerve) extend to that part toward which their fibers converge. If you

keep this in mind you will be convinced, I think, why it is necessary for the nerves to be inserted in the laryngeal muscles from beneath. It will also be understood why the muscles that close and those that open the larynx need not be of the same size. The openers (postici) do not have to oppose the expulsory force of the thoracic muscles," considering which in their physiological role of voice producers he has considerable discourse, and "because of the force necessary for the muscles closing the larynx it needs must be that the nerves should enter them in a straight line with their heads, since by means of the muscles the arytenoid cartilage is dragged upon." . . . If the nerves came from the heart, "as some think, ignorant of all things which concern dissection," this would be provided for by another arrangement, but coming from the head or the spinal cord, as all nerves do, they would enter from above downward and obliquely, except that an all-wise Creator took them into the chest and wound them around the vessels like pulleys, being, as they are, "branches of the sixth nerve," as he called the pneumogastric. "From the posterior part of the brain the derivation descends straight through the whole neck on each side of the aspera arteria, alongside of which there lie certain other small parts joined to it." There is no textual reason why he was not familiar with the relations of the sympathetic and the spinal accessory root, but it is not very easy to be sure we are not imputing more to his objective anatomical knowledge than we have warrant for. However, from this superficial and imperfect sketch, incomplete as it is and exhibiting only partially the enormous discrepancy between his knowledge and ours, in spite of our suspicion that much of his knowledge is derived from his predecessors and his contemporaries, we must recognize in Galen the first great expositor, if not the greatest expositor of the anatomy and physiology of the organs of respiration and the voice who has ever lived, at least of whom we have any knowledge.

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# VASOMOTOR DISTURBANCES OF THE UPPER AIR PASSAGES AND SINUS DISEASE

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In the present paper the term vasomotor disturbances of the upper air passages is used to denote the conditions known clinically as vasomotor rhinitis and asthma.

The term sinus disease is here restricted to those alterations of the ethmoidal sinuses and of the maxillary antrum which are characterized by edematous hypertrophy arising independently of dental infection. Involvement of the frontal and sphenoidal sinuses may or may not be present. Clinically we find all gradations from polypoid degeneration of the middle turbinate to advanced polyp formation. The maxillary antrum usually contains secretion, in some cases seropurulent in character, with a predominance of mucin. In more advanced stages of the inflammation the periosteum becomes the site of infiltration, particularly in the region of the middle turbinate, giving rise to rarefying osteitis. Bacteriological examination of the antral fluid is rarely sterile, at times diphtheroid bacilli, and at others the various cocci, such as the pneumococcus, Staphylococcus aureus and albus, and streptococcus being present.

It does not appear as yet definitely established whether an individual experiences sensitivation to bacteria in the same manner as to proteids entering the system by inhalation or ingestion. In 1916 the writer offered evidence to show that some anaphylactic individuals give a positive skin test to certain bacterial proteids, and that these proteids differ among themselves in their power of causing the skin reaction. Further observation by others, notably by Walker and Rackemann, indicate that anaphylactic individuals may show a wide variety of bacterial sensitivations. In a recent paper by Cooke[1] doubt is expressed whether the group of so-called infectious asthmas can be recognized as a distinct

pathological entity, and the suggestion is made that these may in reality be the result of inhalation of various hitherto unrecognized forms of dust in sensitized individuals.

Without entering into a discussion of this question the writer wishes to state that in a fairly large number of cases the correlation of clinical with laboratory data seems to lend weight to the belief that sensitization to bacteria exists and that this sensitization is apparently responsible for the development of vasomotor rhinitis and for asthma in a certain group of cases.

Even if this point be granted we are not as yet fully clear regarding the nature of such a bacterial sensitization. From the standpoint of systematic botany we might perhaps conceive it to be a sensitization to the proteid of the bacterial body rather than to the products of metabolism of the organism. On this hypothesis the bacterial proteid would be regarded as analogous to the proteid of pollen and of foods. The microörganisms which are recognized as invaders of the upper air passages in acute infections possess the characteristic in common of exerting their influence through the liberation of an endotoxin, that is, a toxic substance existing within the wall of the organism and escaping when the wall becomes sufficiently permeable. This endotoxin is the agent which excites inflammatory symptoms in the invaded individual and gives rise to the phenomena variously of acute rhinitis, pharyngitis, laryngitis, and bronchitis. The anaphylactic individual may owe, however, the occurrence of his particular vasomotor symptoms to the specific proteid of the organism and not to the endotoxin. When he is attacked by one of the organisms in question he experiences, first, the symptoms of a cold in the head or an acute bronchitis from the endotoxin of the organism in question; but these symptoms of inflammation are soon more or less completely submerged with the liberation of the bacterial proteid.

If this hypothesis should prove correct it would perhaps afford an explanation of the immediate skin reactions occurring in some cases on the application of bacterial proteids to a scratch, and at the same time indicate that the reactions occurring after the intradermal injection of vaccines may be toxic manifestations rather than anaphylactic. Improvement observed in the asth-

matic symptoms from the administration of vaccines would then be explained as the result of the establishment of increased immunity to the organisms rather than as a desensitizing process.

Cases have recently come under my observation in which asthmatic symptoms follow a certain type of acute catarrhal infection and are absent in a subsequent attack of acute rhinitis or bronchitis. As an example a woman with chronic ethmoidal and maxillary sinusitis came with a history of nearly constant asthma of several years' duration. Radical operation upon the sinuses was followed by relief of the asthmatic symptoms. Subsequently the asthma reappeared in association with certain acute infections of the upper respiratory tract, but it was found that not all acute infections were followed by asthma. Bacteriological examination of two attacks with asthma showed a sputum with streptococcus, while on three occasions the sputum from acute bronchitis without asthma showed nearly pure cultures of Staphylococcus albus.

There are probably few subjects in which the experience of laryngologists is able to furnish a greater abundance of data than in the one under consideration, but also few in which the evidence of statistics can be more misleading. We are dealing with a number of variable factors, such as the degree of development of the pathological alterations, the kind and number of microörganisms present, these combining in many different ways to exert an effect upon an individual already himself under the influence of other general forces of a beneficial or harmful character.

Furthermore, the operative measures undertaken in a given case may have been faulty or inadequate, with the result of rendering conclusions inaccurate regarding the etiological relationship between the sinus disease and the vasomotor disturbance. These remarks apply with more force to asthma than to vasomotor rhinitis, in which less complexity of the various factors exists. Instead, therefore, of attempting to offer a statistical review of all the cases which have come under my observation, it has seemed to me preferable to present some of the conclusions to which I have been led from a study of patients in private practice, upon which I have operated in recent years, recognizing the fact that these are by no means final but are rather of the nature of suggestions to be criticized and probably modified.

Vasomotor disturbance of the regions under consideration may owe their origin variously to the inhalation of foreign proteids, to the ingestion of foods, to the development within the body of infecting microörganisms, or to the influence of reflex stimuli. In a given case the causative factor may be one or more of these agents operating singly or in association. Consideration in the present paper is limited to conditions of apparently infectious origin or to those in which inhalation and ingestion factors, if present, play an intermittent or subordinate role.

It has not been suggested, so far as I am aware and my observations do not lead me to believe, that anaphylactic disturbances arising from the inhalation or ingestion of foreign proteids, however prolonged, can, in the absence of bacterial infection, give rise to the pathological alterations of the sinuses above mentioned. We often, it is true, see hayfever or an occupational inhalation vasomotor rhinitis, as from horse dander or from flour dust, pass gradually into chronic sinusitis, but careful examination of the patient's history will show a series of attacks of acute rhinitis. Since, furthermore, we cannot distinguish, at least from clinical inspection, between the sinusitis unaccompanied by vasomotor symptoms and that occurring in an anaphylactic individual during the periods between the vasomotor manifestations, it seems reasonable to state that the weight of evidence is at present against the production of sinusitis through the agency of inhaled or ingested foreign proteids.

In relation to the question as to whether sinus disease plays an etiological role in the production of these so-called infectious vasomotor disturbances, we may leave out of consideration the manner in which the sinus itself becomes the seat of infection. We are concerned simply with the determination whether sinus disease, however established, initiates or influences the vasomotor disturbances and consequently whether remedial measures directed to relief of the sinus disease will have a corresponding influence on the vasomotor symptoms.

The essential characteristics of vasomotor rhinitis can be determined with relative completeness. We have a pathological condition corresponding to the familiar wheal produced by the proteid skin test, namely, a serous infiltration and sensory disturbances.

Pallor and swelling of the mucous membrane result, together with an outpouring of fluid and accompanied by sensations of itching with a tendency to sneezing.

These anaphylactic phenomena may occur in nasal mucous membranes which are otherwise essentially normal or they may be superimposed upon tissues already altered by chronic inflammation. In the latter case a knowledge of the pathological conditions will enable us to translate the descriptive clinical terms into their histological equivalents.

Asthma in association with sinus disease may be acute and recurrent or chronic. In the former type we find the individual living for the greater portion of the year in a state of health, but periodically subject to invasion of his mucous membranes by infecting microörganisms. When this invasion develops we find clinically for a few days the symptoms of a cold in the head or of an acute bronchitis, soon, however, succeeded by symptoms of vasomotor disturbance, showing vasomotor rhinitis or asthma. The duration then of the vasomotor affection is like that of an acute nonanaphylactic disturbance of the tissues in question, and after recovery the patient remains free from symptoms until the next invasion.

In the chronic type the individual suffers more or less constantly from asthma, the periods of freedom from symptoms being either brief or absent. Vasomotor rhinitis may coexist with the asthma, although rarely.

In view of the frequent association of sinus disease and of bronchitis the question suggests itself whether there is an etiological relationship in the pathological conditions existing in the regions which predispose them to invasion.

Webb and Gilbert[1] refer to a series of cases of chronic bronchitis in which examination was made of the maxillary and ethmoidal sinuses. In a large percentage of cases sinus disease was found and operative treatment of the sinuses brought about marked improvement in the condition of bronchial inflammation. In numerous instances the patients did not complain of nasal symptoms, although exploration revealed the existence of sinusitis.

In a paper, "Recurrent Influenza in the Nose and Throat," read before this Association in 1910, I called attention to a group

of cases characterized by acute recurrent inflammation of the nose and throat with secondary involvement of the bronchial tubes. The past history is one of annual attacks of inflammation entering the lymphoid tissue of the pharynx and extending promptly to the ethmoidal and maxillary sinuses, with involvement of the trachea or bronchial tubes. Purulent discharge appears in the nose and simultaneously cough with purulent expectoration. Examination of the chest shows bronchitis limited to a small well-defined region.

If the group of symptoms above described occurs in an anaphylactic individual the symptoms of inflammation may be accompanied by manifestations of asthma which dominate the clinical picture.

It does not appear possible to determine in a given case the relative amount of absorption of bacterial proteids from the mucous membrane of the sinuses and of the bronchi respectively. We may be able to form only an approximate estimate derived from clinical data concerning the degree of development of the sinus disease, the extent of the bronchitis, and the existence of bronchiectasis. In advanced cases of bronchial diseases specially associated with myocarditis it would seem of doubtful value to perform radical operation on the nasal sinuses solely for the purpose of restricting the amount of absorption of bacterial proteids.

If, on the other hand, an etiological relationship exists between sinus disease and chronic bronchitis the operative removal of a pathological condition in the nose would be very definitely indicated for the purpose of relieving the bronchial inflammation or at least restricting its further development.

The operative management of these conditions of sinus disease in anaphylactic individuals does not differ from that in the ordinary case. It is, however, of special importance to determine with accuracy the condition of the antra. Evidence obtained from transillumination and the roentgen ray may be misleading, since these methods may show simply the existence of a disparity in the illumination of the two sides. It is possible that one antrum may be opaque and the other relatively clear, but nevertheless both may have fluid in the interior. One side may be in a more

advanced stage of inflammation with greater thickening of the mucous membrane than the other. In all the cases which I see now, when I have reason to suspect the existence of sinus disease, I do a paracentesis on both sides and have repeatedly found fluid in the antrum which had been pronounced normal by the roentgen ray.

The antral opening should be enlarged to avoid any possibility of closure and to permit the free escape of the frequently thick viscid fluid. A larger opening is required in these conditions than in the case of simple empyema of the antrum, where the fluid is thinner and more readily capable of flowing out through a small opening.

If the ethmoidal regions are affected it is desirable to remove the anterior end of the middle turbinate and curette the anterior ethmoidal cells.

Results of operative treatment in chronic vasomotor rhinitis of the type under consideration have been satisfactory in the larger proportion of cases and the patients have remained free from symptoms except in the event of their experiencing a subsequent attack of acute infection when a transitory form or vasomotor disturbance may appear. Such a condition is illustrated by the following case:

Mrs. R., aged thirty-five years, was seen November 18, 1920, with a history of vasomotor rhinitis, of one year's duration, following a severe cold. Examination showed general pallor of the mucous membranes of the nose with polypoid degeneration of both middle turbinates. Transillumination was dark on the right side. All skin tests for foods, pollens, and dusts were negative. Both antra were opened through the lower meatus and the ethmoidal cells curetted. The right antrum was filled with thick viscid mucus which showed numerous colonies of Staphylococcus albus and ozena bacilli. The vasomotor symptoms disappeared after the operation. One year later the patient had an acute rhinitis accompanied by vasomotor symptoms, the whole process clearing up, however, within a few days.

Four other cases of essentially similar type have been operated on in the past two years with the result of definite relief of the vasomotor symptoms.

In 16 patients showing sinus disease associated with asthma of the type under consideration results of operative treatment have been beneficial, so far as the asthma is concerned, in the majority of the cases. Sometimes after the operation the asthma subsides or remains absent for a while but reappears later. Some unsatisfactory results have been manifestly due to imperfect operative technic in the sinus operation where fluid has reaccumulated in the antra. Washing out of the fluid has been followed by relief of the asthma. Establishment, however, of a large antral opening, which requires no washing, has been followed by a larger number of successful results. In a certain proportion of the cases the change in the clinical picture has been from chronic persistent asthma into an acute recurrent asthma, the patient remaining for a much greater time free from disturbance; but on the development of a cold or acute bronchitis, or after other forms of reflex strain, again experiencing attacks. It has seemed to me probable that the improvement in the chronic asthma is due chiefly to a lessening of the bronchitis and consequent diminution in the amount of bacterial proteid absorbed from the bronchial tract. This view is in harmony with the observations above mentioned regarding the relief of bronchitis by the eradication of sinus disturbance.

My experience with vaccines in these cases of vasomotor disturbance with sinus disease leads to the conclusion that they are of relatively little value so long as the diseased state of the sinus persists. It is only after the clearing out of the pathological disturbances in the ethmoidal and maxillary sinuses with the establishment of permanent free drainage in the latter that they are of service.

Where, however, this has been done the administration of autogenous vaccines, which by the intradermal test excite definite reaction, has appeared to exert a material influence upon the asthmatic symptoms.

It must be emphasized that the management of asthma with sinus disease is not alone a problem for the laryngologist but requires the close coöperation of the internist, with constant supervision by the latter of the patient.

Operation on asthmatics with sinus disease should not be

undertaken until all possible extrinsic causes, as from dust and foods, have been eliminated. It happens not infrequently that a case which appears to belong to this category of infectious asthma may in reality owe the disturbance to the presence of a cat or dog in the house or to some article of food in the diet. The observations of Cooke on the influence of house dust are of great importance in this connection. The possibility of infection from the teeth must be remembered.

The degree of development of the bronchitis, the presence of bronchiectatic cavities, and association of myocardial affections of the heart must be taken into consideration. If the pulmonary lesions are advanced little or no benefit may be obtained. In patients with myocarditis an operation may be contraindicated. As an example:

H. B. developed ten years ago asthma and bronchitis following influenza, with annual attacks of bronchitis subsequently. In October, 1921, the asthma became more pronounced and there was evidence of beginning myocarditis. Both antra were dark on transillumination and considerable mucopus was present in the nose. Extrinsic causes of asthma were eliminated. Findings were typical of infectious asthma, and an operation would have been performed, except for the condition of the heart, which showed signs of rapidly increasing weakness. The patient died in January from heart failure.

Conclusions. A group of vasomotor disturbances characterized by vasomotor rhinitis or by asthma exists, standing in relation to chronic infection of the nasal sinuses. In vasomotor rhinitis the sinusitis is probably the direct cause of the disturbance. In asthma of this type it is not wholly clear what part in the production of the disturbance is played directly by the absorption of bacterial proteids from the sinuses. There is reason to believe that the sinusitis has an etiological relationship with the associated bronchitis. Relief of the sinusitis is usually followed by diminution in the bronchitis and asthma unless the bronchial lesions are old and extensive or associated with myocarditis. Operative treatment of the sinusitis consists in adequate removal of diseased conditions in the ethmoid bone with the establishment of large openings into the antra to permit the spontaneous evacuation of the antral fluid.

## SUMMARY OF CASES

Case I.—M. A., aged seven years, asthma of four years' standing associated with frequent colds and attacks of bronchitis. Right maxillary and ethmoidal sinusitis. Chronic tonsillitis. Antral fluid showed Staphylococcus albus and Streptococcus pyogenes. Operation on sinuses. Asthma disappeared and remained absent for nine months, but reappeared on taking cold, lasting moderately for two weeks. Two attacks of asthma occurred during the following year in association with acute infection. No trouble during the last six months. Chest now clear.

Case II.—Mrs. E. F. S., aged thirty-five years. Chronic asthma and bronchitis of many years' duration. Marked maxillary and ethmoidal sinusitis. Operation on sinuses. Staphylococcus aureus in antral fluid. Asthma and bronchitis gradually cleared up. Has been well during the past year.

Case III.—W. A., aged fifty years. Asthma and bronchitis of fifteen years' duration, following severe cold. Ethmoidal and maxillary sinusitis. Operations on the ethmoid done repeatedly without relief to the asthma. Autogenous vaccine from Staphylococcus albus and streptococcus given without result. One year ago both antra opened, the left showing considerable mucopus. The bronchitis has improved and for the past year has had no asthma.

Case IV.—S. W. M., aged sixty-nine years. Asthma of many years' duration. Chronic maxillary and ethmoidal sinusitis. Much viscid mucus removed from the right antrum showing Staphylococcus aureus. Gradual improvement in bronchitis with diminution in wheezing. No symptoms during the past year.

Case V.—Mrs. F. W. N. Asthma for many years, recurrent. Maxillary and ethmoidal sinusitis. Operation. Improvement in asthma and bronchitis during the following three months. Remained then free from asthma until streptococcus bronchitis one year ago, lasting one month. Since then she has been free from disturbance.

Case VI.—M. A. aged forty years. Asthma for several years with bronchitis. Many operations have been done for removal of polypi

Marked inflammation of the ethmoidal bones; opacity over the antra. Operation on sinuses. Slow improvement during the following six months; had attacks of asthma, however, being less frequent and severe. Seen two years after operation, having had no asthma during the previous year.

Case VII.—Mrs. G. E. K. Thirteen years ago chronic right maxillary and ethmoidal sinusitis were observed. A radical operation was done. Now right frontal sinus shows considerable secretion. Intranasal operation on the right frontal sinus. Four months later asthma began gradually, increasing, in association with involvement of the left antrum. Antral fluid showed Staphyloeoccus aureus and albus. Autogenous vaccines from these followed by no relief. During the following year the asthma became more troublesome and infection of the right antrum was observed. In May, 1920, both antra were opened freely and polypoid enlargement of the left middle turbinate removed. Has had no asthma for two years since operation.

Case VIII.—Miss E. F. M., aged seventy years. Seen first fourteen years ago. Had asthma of many years' duration. Had repeated operations on the ethmoidal sinuses without relief. Sinuses were then curetted without improvement of the asthma. During the next eight years there was no essential change in the asthma and chronic bronchitis was noted. In 1913 the right antrum became infected and was tapped, with the removal of much pus. Autogenous vaccines were administered without relief. Five years ago the tonsils were removed and showed a large amount of detritus. Chest examination showed extensive chronic bronchitis with a moderate degree of myocarditis. Asthma still intermittently troublesome. No definite result could be shown following the various operations.

Case IX.—D. D., aged thirty years. Bronchitis for two years following severe strain during the late war. Marked ethmoidal sinusitis. Marked ethmoidal sinusitis. No involvement of the antra. Curettage of the ethmoids was done nine months ago. Antra were opened. No fluid found. No relief following operation.

Case X.—Mrs. C., aged fifty years. Seen seventeen years ago. Asthma of many years' standing with chronic bronchitis. Marked ethmoidal sinusitis. In 1906 a large amount of degenerated ethmoidal

tissue was curetted on both sides. Asthma has persisted more or less constantly since. It has not been possible to obtain consent for operation on the antra, although these are evidently infected, as shown by the roentgen ray. Now has extensive chronic bronchitis with myocarditis.

Case XI.—Mrs. C. H. M. Asthma for ten years, more or less constant. Some operation on sinuses was done ten years ago with removal of the anterior ends of the middle turbinates. Transillumination at the time of the examination was dark both sides. Curettage of ethmoidal cells with large opening into each antrum. Antral fluid showed streptococcus. Asthma has been troublesome since the operation during the past six months following operation, but as the patient lives at a distance it has not been possible to follow the condition accurately.

Case XII.—Mrs. E., seen August, 1914. History of infection of the right antrum the previous spring with asthma more or less constant, conditions persisting throughout the summer and winter with each cold. In August, 1915, both antra were tapped; a large amount of fluid was removed, the asthma nevertheless persisting. In October the antra were again opened and a large amount of viscid mucus removed from the left. Middle turbinotomy. Improvement followed, lasting several months, asthma again returning. The sinuses were repeatedly washed, with temporary relief. In 1916 had no asthma throughout the summer. Both antra were free. In the winter of 1916 the asthma reappeared with evidence of myocarditis. In January, 1916, large free openings were made into each antrum, which showed a quantity of viscid mucus. Cultures of this fluid showed diphtheroid bacilli, a few streptococci, and occasionally colonies of staphylococcus. Asthmatic attacks persisted throughout the winter of 1918 and 1919, becoming extremely severe in March with progressive heart failure, from which the patient died March 16.

Case XIII.—Mrs. G. Y. B., aged forty years. Asthma and chronic bronchitis for many years; chronic tonsillitis; chronic ethmoidal and maxillary sinusitis; tonsillectomy and operation on sinuses. Staphylococcus albus in antral fluid. Asthma disappeared, remaining absent for three months. In the past six years had five short attacks of mild acute bronchitis and asthma.

Case XIV.—Mrs. A. P., aged thirty-five years. Asthma for several years, generally persistent. Chronic ethmoidal and maxillary sinusitis. Streptococcus in antral fluid. Operation. Asthma became progressively less severe during the following two years. For past three years had no asthma.

Case XV.—Mrs. J. B. P., aged thirty-five years. Asthma for several years, which was generally persistent; chronic bronchitis; chronic ethmoidal and maxillary sinusitis; antra opened; cultures of antral fluid showed Staphylococcus albus and pyogenes. Since operation, five years ago, attacks of asthma were infrequent, usually brief and following colds or overwork.

Case XVI.—Mrs. M. F. R. Frequent attacks of asthma and bronchitis also chronic ethmoidal and maxillary sinusitis. Operation. Since operation, three years ago, has had no asthma.

Remarks. In all the above cases skin tests for foods and pollens were negative, or if positive the influence of these factors upon the asthma was definitely eliminated. Unless otherwise stated the operation consisted in exenteration intranasally of the ethmoid and establishment of an opening into the antrum through the lower meatus.

The statement "no asthma" denotes that the patients have been free from symptoms of the type which had previously troubled them. Excessive fatigue, nervous strain, or exposure to certain dusts or foods in patients sensitized to such proteids have been sufficient to excite a temporary recurrence of the asthmatic symptoms.

## References

1. Cooke: Jour. Immunol, March 1922.
2. Webb and Gilbert: Jour. Am. Med. Assn., 1921, p. 714.

# OBSERVATIONS ON HAYFEVER

I. CHANDLER WALKER, M.D.

The symptom-complex to which John Bostock in 1819 gave the name hayfever may attack an individual at various seasons of the year or may be present more or less continuously throughout the entire year. The former is called seasonal hayfever and the latter is called perennial hayfever. Seasonal hayfever is a very common complaint, and it has been estimated that 1 per cent of the population of the United States is so afflicted. Perennial hayfever is much less common, however; if it is proper to include those cases which are subject to frequently repeated head colds and those which have vasomotor rhinitis, both of which conditions are not very unlike perennial hayfever, it then becomes a very frequent complaint.

Perennial Hayfever. Perennial or all the year hayfever is very often caused by the inhalation of the proteins of the hair, dandruff, or skin dust of the horse, dog, cat, and other fur-bearing animals such as pets, and fur wearing-apparel. The same holds true for the feathers of the chicken and goose, for example, feather pillows, and feathered pets, such as parrots. The inhalation of plant pollens at a definite season may predispose to a perennial hayfever, and a seasonal hayfever caused by pollens such as timothy grass and ragweed may become an all-the-year condition, due to other superimposed causes. The inhalation of the flour of the cereal grains is not infrequently a cause of perennial hayfever; such instances are confined to bakers, cooks, and those who handle the various types of flour and ground-up grain. In fact the inhalation of any kind of organic dust may cause perennial hayfever; instances of this are the inhalation of face powders and of boxwood and orangewood dust by jewel polishers, etc. Therefore the patient's occupation, habits, and surroundings may

have a bearing on the cause of the symptoms in this inhalation type of perennial hayfever.

Another group of cases of perennial hayfever we designate as the ingestion type, and this concerns the eating of food proteins. Although in my experience eggs, wheat, and milk are the usual food proteins that are found to cause this condition, tests should be done with all of the common foods that the patient is continuously or frequently in the habit of eating. Among the common foods that seem essential to routinely test are egg, wheat, milk, rice, corn, oat, potato, pea, bean, beef, lamb, pork, and chicken; additional foods may be determined from the patient. Examples of unusual foods causing perennial hayfever follow. A woman had hayfever from eating raw carrots, which she craved and ate every day; another had hayfever whenever she ate celery; a third patient noticed that among other foods onions caused hayfever.

The above-mentioned two types of causes of perennial hayfever, namely, the inhalation and the ingestion types, may be determined by means of skin or cutaneous tests, the technic of which follows: A number of small cuts, each about an eighth of an inch long, are made on the flexor surfaces of the forearm. These cuts are made with a sharp scalpel, but are not deep enough to draw blood, although they do penetrate the skin. On each cut is placed a protein and to it is added a drop of tenth normal sodium hydroxide solution to dissolve the protein and to permit of its rapid absorption. In the case of pollens, animal hair, and feathers a concentrated solution of pollen protein or animal hair extract may be used without the addition of sodium hydroxide. At the end of half an hour the proteins are washed off and the reactions are noted, always comparing the inoculated cuts with normal controls on which no pollen was placed. A positive reaction consists of a raised white elevation or urticarial wheal surrounding the cut. The smallest reaction that we consider positive must measure 0.5 cm. in diameter.

The treatment of the above-mentioned two types of perennial hayfever, namely, the inhalation and ingestion types, consists chiefly in the omission of the offending protein as determined by the positive skin test. Therefore, treatment may consist of the

omission of a food from the diet, or the avoidance of domestic animals and pets, or discarding the feather pillows, or a change in occupation, or discontinuing the use of a certain face powder, etc. Since the avoidance of exposure to animals is not always possible and the avoidance of exposure to common pollens is rarely possible, desensitizing treatment may be given for the former and should be given for the latter. This method of treatment will be described later on when we discuss seasonal hayfever.

A third type of perennial hayfever we call infectious type because bacteria seem to be the prominent cause. This type is determined by the process of exclusion, and it comprises those patients who not only fail to give a positive cutaneous test but also have no demonstrable rhinological cause. In other words, cutaneous tests and rhinological examination have failed to determine the cause of symptoms. For the treatment of this infectious type of perennial hayfever we have to resort to vaccines. Although stock vaccines sometimes give good results, it is best to use autogenous nasal vaccines, which are prepared by inoculating the patient's nasal secretion either into dextrose bouillon or into blood-agar plates. Vaccine treatment should not be given oftener than at five-day intervals and preferable only at weekly intervals, and the dose of vaccine should be gradually increased.

A fourth type of perennial hayfever has already been casually mentioned and concerns the rhinologist. Among the various causes may be mentioned the presence of polyps, adenoids, spurs, sinus infection, etc. The rhinologist will determine the cause and treatment of this type; when, however, he fails, autogenous nasal vaccines are worth trying and often benefit.

Dr. Goodale has called attention to a pseudo-hayfever due to the fragrance of certain heavily scented flowers. It seems to me that this pseudo type of hayfever is due to many causes which may be classified as mechanical, chemical, odorific, and thermal. Among the mechanical causes any kind of dust is the most frequent cause, more especially sweeping dust and hay dust; fine powder, such as talcum and the like, is also a frequent cause. Among the chemical irritants, soap powder, lye, and ammoniacal fumes are very frequent causes. Among the odorific irritants, heavily scented perfumes, face powders, musty air, and stable

odors are frequent causes. Thermal irritants concern sudden changes of temperature, as in going from warm air to extreme cold, from moist air to very dry air, and exposure to drafts; a very frequent history is that of a paroxysm of sneezing with or without running of the nose on retiring and on arising. The mechanism seems to be a reflex due to the sudden exposure of the warm and protected skin of the body to cold air, as in getting out of bed and in undressing, during which acts the warm body surface is suddenly and momentarily exposed to cool air; in other words, there is a mild chilling of the body surface. The same mechanism holds for many who take cold easily. Some of these patients are sensitive to some type of protein which may have rendered their nasal mucous membranes sensitive to these irritants; others are not sensitive to proteins. Appropriate protein treatment for those who are sensitive usually relieves these symptoms no matter what the irritant may be, and occasionally autogenous nasal vaccines will benefit or relieve the nonsensitive individual.

Therefore, to summarize, I think that the following procedures offer the best results in the determination of the cause and treatment of perennial hayfever: First, do routine cutaneous tests with the common food proteins, common pollen proteins, and domestic animal hair proteins; the need of testing with unusual food proteins, face powders, and other unusual types of proteins depends upon the customs and habits of the individual in question. A positive test followed by omission of the protein yields satisfactory results.

With those patients in whom cutaneous tests fail to determine the cause an examination of the nasal cavities and sinuses may reveal the cause. Autogenous nasal vaccines often have to be given even though previous examinations and tests have or have not revealed a cause. The same procedure of testing, rhinological examination, and vaccine therapy may be applied to the condition of frequent colds. With the vasomotor rhinitis cases I should put rhinological examination first, then if necessary cutaneous tests and autogenous vaccines. The possibility of a pseudo-hayfever must be borne in mind, and this may be a primary condition or secondary to other causes.

Seasonal Hayfever. For convenience we classify or divide seasonal hayfever into three groups, namely, spring, summer, and autumn. The spring type concerns those who have symptoms during February, March, April, and May, and the causative agent is usually the pollens of trees. The summer type concerns those who have symptoms during late May, June, and July, and the causative agent is usually the pollens of the grasses. The autumn type concerns those who have symptoms during August and September, and the causative agent is usually the pollen of ragweed—dwarf ragweed in the East and giant ragweed in the West. Naturally the season of pollination of these various plants may vary according to the locations; however, the history of the patient will tell the time of year when symptoms are present, and it is up to you to determine the prevailing causative pollen. What I shall tell you applies to the New England States, and this will give you a working knowledge for your respective localities. In fact, I am inclined to believe that the causative pollens do not vary very much for different localities, but the time of pollination of the same plant does vary in different localities.

Hayfever Caused by the Pollen of Trees. The first pollen season begins in February and continues into May, during which time various trees pollinate. Silver maple often pollinates in February; the other maples, birches, willows, and hazelnut pollinate in late March or early April; the poplars, juniper, cottonwood, and elm pollinate during April; the oaks, ash, bayberry and hickory pollinate during May; the pines pollinate in late May and in early June, and the fruit trees pollinate in May. I have observed twelve patients who were sensitive to and had hayfever from the pollen of trees. One patient had hayfever caused by the pollen of apple blossoms, and he was free from symptoms following preseasonal treatment with its pollen extract. One patient who was sensitive to the pollen of the oak and maple and another who was sensitive to the pollen of the willow were both free from symptoms following preseasonal treatment with these pollen extracts. Patients not treated were those sensitive to the following tree pollens: 1 patient to poplar tree pollen; 1 to pine tree pollen; 2 to ash; 1 to willow; 2 to both willow and poplar, and 1 to willow, poplar, and ash. Since the season of

pollination of the individual trees continues only from a few days to two weeks at the most it does not seem essential that treatment be given. However, treatment may be successfully given for tree pollens in the same manner as for other pollens, for which treatment will be detailed later on.

Causes of the Summer Type of Hayfever. Patients who have hayfever during late May, June, and July, the so-called rose-cold period, are exposed to many kinds of pollens, but actually the pollens of only the grasses cause much trouble. In the New England States some of the compositæ, the most important of which is the daisy, pollinate at this time; but, for reasons given later on, daisy pollen rarely, if ever, is a cause of hayfever. Such plants as the lilies, sorrel, buttercup, and others pollinate at this time, but when tested no patient has been found to be sensitive to these, and if they ever cause hayfever it is because of immediate nasal contact with the blossom. The rose, which pollinates at this time, is rarely a cause of hayfever, since it is not a wind-pollinated plant. Since, however, the rose is commonly suspected to be the cause of hayfever or rose colds, and since the pollen of the rose is occasionally the actual cause, skin tests with rose pollen frequently have to be done, if for no other reason than to satisfy the patient. So far I have had reason to treat only three rose cases.

The cause of hayfever during June and July in the New England States is practically limited to the pollens of the grass family. Lawn grass begins to pollinate early in May, as a rule; but, since it is rare for hayfever to begin early in May, lawn grass pollen is probably rarely, if ever, the chief cause of hayfever. Since, however, lawn grass continues to pollinate throughout the summer even when it is repeatedly mowed closely, with those patients who are sensitive to the pollens of other grasses, and are either not treated or are insufficiently treated with the particular grass pollen that is the chief cause of hayfever, exposure to lawn grass pollen may be a complicating cause or may aggravate the symptoms of hayfever. Orchard grass pollinates during July, but this type of grass grows in more or less secluded places and it is not commonly encountered. I have not tested a patient who reacted strongly to orchard grass. Since corn is a member of the grass

family, and since the table variety pollinates during July, it must be considered among the possible causes of early hayfever. Corn pollen is very heavy, it rapidly descends to the ground, and is carried by air currents or wind only a few feet, therefore intimate exposure would be required to produce symptoms; furthermore, only rarely would a person be unable to avoid it. Therefore, corn pollen must rarely, if ever, be considered a cause of hayfever in the New England States, where no large acreage exists in any locality, as is the case in the West. This same statement is likewise true of wheat, oats, barley, and rye.

The grasses, then, with which we are concerned in New England are June grass, timothy, and redtop, the pollens of which are light and are carried by the wind considerable distances. June grass begins to pollinate some years as early as the middle of May; when the season is very late it does not pollinate before the last day or two in May; pollination continues for about three weeks. Timothy and redtop begin to pollinate between the middle of June and the first of July, depending on the season, and pollination continues until the middle or last of July; usually the season of pollination lasts about six weeks. Therefore, in order to complete the schedule of treatments mentioned later in this paper as being desirable, preseasonal treatment with June grass must begin the first of March at the latest, and with timothy and redtop it must begin the middle of March.

Causes of Autumnal or Late Hayfever. In the New England States ragweed (*Ambrosia artemisifolia*, or dwarf ragweed) is not the only plant that pollinates during August and September, nor is it the only pollen to which individuals are exposed or with which patients should be tested. Most of the compositæ, such as golden rod, sunflower, golden glow, and aster pollinate during August and September; the daisy pollinates during June and July and the dandelion in the early spring; giant ragweed is rarely encountered in the New England States. In my experience, however, pollens other than ragweed rarely, if ever, are the chief cause of symptoms during the late hayfever season. I have tested one hundred and seventy patients with the pollens of the daisy, golden rod, sunflower, and golden glow. Fifty per cent of those tested with these pollens gave a positive

reaction with the whole pollen, but none of these gave a reaction with a 1 to 100 dilution of the pollen; the other 50 per cent failed to react at all with the whole pollen. Therefore it may safely be stated that the pollens of golden glow, sunflower, daisy, and golden rod are not primarily causes of hayfever in New England. It should be borne in mind that the daisy pollinates during June and July and has finished pollination before ragweed begins, therefore the daisy cannot complicate the cases of August and September hayfever. In comparison with ragweed, in only 3.25 per cent of my cases could golden rod pollen be assumed as a possible cause of hayfever. From the investigations of Scheppegrell and others we know that the pollens of golden rod, sunflower, golden glow, daisy, and aster are not carried by the wind and that their pollens are heavy and shed very sparingly, so that for these reasons patients are not exposed to these pollens unless the flowers are kept in the house or unless sensitive patients smell of the flowers; naturally, the patient can refrain from such intimate contact and need not be treated for these.

I have outlined the pollens that may be the possible cause of hayfever at various seasons and I have also described the cutaneous test which when used with these pollens will determine the probable cause. Before treatment may be given it is essential to do cutaneous tests with various dilutions of the pollens or pollen protein in order to determine to which pollen of several the patient is most sensitive, and with which pollen the patient should be treated, and with what dilution of the pollen treatment should be begun. Treatment should not be given with a dilution of pollen that gives a reaction on the skin, but treatment should be begun with the strongest solution that fails to give any reaction whatever.

These solutions I make as follows: To 0.5 gm. of the dry pollen is added 44 cc of sterile physiological sodium chloride solution and the mixture is shaken thoroughly at frequent intervals for twenty-four hours, after which enough absolute alcohol (6 cc) is added to the mixture to make the alcoholic content 12 per cent. Again, the mixture is thoroughly shaken at frequent intervals for twenty-four hours, after which it is centrifugalized at high speed and the supernatant fluid is pipetted off and saved.

This supernatant fluid, therefore, consists of the pollen protein dissolved in a 12 per cent alcoholic physiologic sodium chloride solution, and it represents, by weight, 1 part pollen to 100 parts solvent. This 1 to 100 solution is used as stock, and from it other dilutions, 1 to 500, 1 to 1000, 1 to 5000, and 1 to 10,000 are made, using a 12 per cent alcoholic physiologic sodium chloride solution as a diluent. These solutions are used not only for the skin tests but for treatment, and with the addition of a small crystal of thymol they keep for many months in a cool place.

Method of Treating Preseasonally with Pollen Extracts. The first treatment consists of from 0.1 to 0.2 cc of that dilution next higher than the one which gave a positive skin test, or, in other words, the first dose is 0.1 cc or 0.2 cc of the strongest dilution which failed to give any skin reaction whatever, no matter how slight. With my pollen extracts the majority of patients whom we treated gave a more or less positive reaction with the 1 to 10,000 dilution, therefore the first treatment consisted of 0.1 cc or 0.2 cc of the 1 to 20,000 dilution. Treatments are given subcutaneously once a week and each week the amount of the extract is gradually increased, so that as the treatment progressed stronger and stronger dilutions were used, until one or more doses of the 1 to 100 dilution were given. As an example I will give what I have found by experimentation to be the best outline of treatment for a patient who gives a more or less positive skin test with a 1 to 5000 dilution of pollen extract: 1 to 10,000 give 0.15 cc; 1 to 5000 give 0.15 cc, 0.25 cc, 0.35 cc, 0.45 cc; 1 to 1000 give 0.15 cc, 0.25 cc; 1 to 500 give 0.15 cc, 0.25 cc, 0.35 cc, 0.45 cc; 1 to 100 give 0.15 cc, 0.2 cc, 0.25 cc. Each dose was given preferably at weekly intervals and never oftener than once every five days.

This schedule of treatment calls for fourteen inoculations, however, for some reason or other modifications frequently have to be used. Often a patient is so sensitive to the pollen that a 1 to 10,000 dilution gives a slight reaction, thus necessitating an initial dose of 0.15 cc of 1 to 20,000 followed by possibly two doses of 1 to 10,000. Often it happens that a patient has considerable local or general reaction following some one treatment in the schedule, thus necessitating the repetition of that partic-

ular dose before the next increase may be given. More often the patient presents himself for treatment too late to complete the scheduled series of treatments before the onset of pollination, so that for preseasonal treatment alone some of the final treatments in the schedule must be omitted. This schedule is often modified purposely with certain individual cases. For instance, in some cases the second treatment with the 1 to 1000 dilution, namely, 0.25 cc, is omitted, and in some cases instead of giving 0.15 cc of the 1 to 100 dilution, when this happens to be the final treatment that the patient is to receive because of onset of pollination, a fifth treatment with the 1 to 500 dilution, namely, 0.55 cc, is often substituted, and even a sixth treatment with the 1 to 500 dilution, namely, 0.65 cc, is sometimes given. These larger doses of 1 to 500 approximate the amount of protein in 0.15 cc and 0.2 cc of the 1 to 100 dilution, therefore the fifth and sixth treatment with the 1 to 500 dilution, as outlined, is practically the equivalent of giving 0.15 cc and 0.2 cc of the 1 to 100 dilution. Since by far the great majority of patients are treated from three to five times with the 1 to 500 dilution, and since this number of treatments has given fairly satisfactory results, I consider this number of treatments, which consists usually of a total of ten, as worth giving, although a continuance of the schedule beyond three doses of the 1 to 500 dilution is most desirable, and giving less than three treatments with the 1 to 500 dilution is undesirable.

Since in the New England States the majority of autumnal hayfever patients have their first symptoms between August 10 and 20, during which time the compositæ, chiefly ragweed, begin to pollinate, in order to complete the above schedule just previous to the onset of symptoms and pollination patients must begin treatment between the last week in April and the first two weeks in May. Beginning treatment the first week in June permits of giving from three to five treatments with the 1 to 500 dilution. Likewise since the early type of hayfever, or so-called rose cold, which is usually caused by the grasses, begins the last few days of May or the first of June, treatment for this type of hayfever should begin about the first of March, and the starting of treatment as late as the first of April will not permit of

more than three or four treatments with the 1 to 500 dilution, according to the schedule outlined. Naturally in localities outside of New England these seasons would differ and the beginning of treatment consequently would vary, also the causative pollen must differ.

My conclusions, based on a four years' experience with the treatment of June and July hayfever, are: While the pollen of timothy grass is the chief cause of hayfever, and sufficient treatment with it alone gives excellent results, it is necessary to test all patients with the pollens of redtop, June grass, and the rose, since an occasional patient is more sensitive to one of these pollens than to timothy pollen, and, therefore, such a patient may need treatment with one of them rather than with timothy pollen. When the same patient, as is frequently the case, is equally sensitive to the dilutions of the pollen extracts of timothy, redtop, and June grass, it is advisable to treat the patient with timothy pollen extract alone because there is sufficient evidence that treatment with timothy pollen will protect against redtop pollen exposure, provided one or more treatments are given with the 1 to 100 dilution of the pollen extract; timothy and redtop pollinate at the same time and redtop is less prevalent than timothy. Sufficient treatment with timothy pollen extract seems to protect also against June grass pollen exposure, but since, as is often the case, June grass pollination is well advanced or even sometimes completed before timothy pollination begins, the patients being treated with timothy have not had sufficient treatment with timothy pollen to protect them completely against June grass pollen, consequently some of these patients will have more or less symptoms from June grass exposure. Treatment with both timothy pollen and June grass pollen extracts together will not only be insufficient to protect against early June grass pollination, but the combination of the two pollen extracts necessarily retards and diminishes the amount of treatment that might be given with timothy alone. Therefore, I am opposed to treatment with pollen mixtures, except on rare occasions, and in the case of June grass it is better to take a chance on a late season with timothy protection or even an early season with few symptoms than to treat with it in conjunction with timothy

when timothy treatment is essential. Rarely one mets with a patient who has hayfever only from early in May to the middle of June; in such a case treatment with June grass alone is advisable and usually sufficient. Rarely it is necessary to treat with rose pollen or some other grass than those mentioned; however, the cutaneous tests will determine this for you.

I have treated, according to the scheme already outlined, 115 grass cases of hayfever and the results from the first year's treatment follows: 28.7 per cent were free from symptoms, 21.7 per cent were practically free, 23.5 per cent were 75 per cent benefited, 21.7 per cent were 50 per cent benefited, and 4.3 per cent were not benefited. Therefore from the first year's treatment given preseasonally for grass hayfever you may expect equally good results. Treatment of the same patient in successive years yields even better results, therefore you can give your patients a better prognosis the second year than the first year, provided as much or more treatment is given the second year as was given the first year.

My conclusions, based on four years' experience with the treatment of August and September hayfever, are that ragweed is practically the only pollen with which treatment is necessary; dwarf ragweed in the East and either dwarf or giant as the case may test in the West. In various localities there may be some pollen other than ragweed that is a causative factor. I have treated 420 cases with ragweed pollen with the following results for the first year's treatment: 21.5 per cent were free from symptoms, 17.5 per cent were practically free, 25.5 per cent were 75 per cent benefited, 29 per cent were 50 per cent benefited, 6.5 per cent were not benefited. Therefore from the first year's treatment you may expect equally as good results and from successive years' treatment you may expect even better results.

The permanency of benefit from treatment seems to depend largely upon the individual and to some extent upon a large amount of treatment which renders the patient nonsensitive. After two or three years of consecutive treatment the majority of patients will continue free or practically free from symptoms for another two or three years without treatment; after this period of time symptoms return more or less gradually. Occasionally

a patient will be free only one year before symptoms return and occasionally symptoms will be as severe the first year that treatment is omitted. Rarely one season's treatment will protect for several years, and I think treatment every other year with some individuals will keep the patient quite free from symptoms; as a rule I feel it best to give two or three successive years' treatment before permitting omission of treatment.

During-the-Season or Curative Treatment with Pollen. Frequently patients present themselves for treatment during their hayfever attack, and although pollen treatment at this time does not seem to be very logical, on the basis of anaphylaxis, the patient often will insist on taking the chance. Pollen treatment during the season does not seem logical because the patient is being injected with the pollen which is causing symptoms at the same time that he is being exposed to the pollen present in the air which he is inhaling. The danger resulting from large doses of the injected pollen is obvious because of an overdose, due to the combination of the injected pollen and the inhaled pollen. Therefore in order that during-the-season treatment should be beneficial the patient must be injected with minute amounts of the pollen extract in order to diminish artificially a few of the patients' antibodies, thus leaving a smaller number of antibodies in the patient for combination with the pollen antigen that is inhaled. If too much pollen extract (antigen) is injected the patient should have symptoms due to overtreatment alone, or he should be made worse, due to the injection of pollen extract (antigen) superimposed on the inhalation of pollen (antigen). It is evident that on the basis of anaphylaxis during-the-season treatment is hazardous, and although the skin test is the best guide as to the proper treatment there is no way of controlling the amount of pollen that the patient may inhale.

The results from during-the-season treatment with grass pollens were: Of 22 patients treated, none were free from symptoms; 7, or 32 per cent, were practically free; 4, or 18+ per cent, were 75 per cent benefited; 3, or 13+ per cent, were 50 per cent benefited; the same number were 25 per cent benefited, and 5, or 22+ per cent, were not benefited. Since no patients were entirely relieved of symptoms, and since a large percentage were not bene-

fited, it is evident that preseasonal treatment ensures better results by far than does during-the-season treatment. If preseasonal treatment is absolutely barred, during-the-season treatment is worth trying, provided it is given with sufficient care and the skin test is used as a guide to the initial treatment.

The results from during-the-season treatment with ragweed were: Of 27 patients, 3, or 11+ per cent, were free from symptoms; 1 patient, or 3+ per cent, was practically free; 3 patients, or 11+ per cent, were 75 per cent benefited; 7, or 25+ per cent, were 50 per cent benefited; 1 patient, or 3+ per cent, was 25 per cent benefited, and 12 patients, or 44+ per cent, were not benefited. Therefore although a few patients were free from symptoms and as many more were 75 per cent benefited, the number who were only 50 per cent benefited was as great as the number who were more than 50 per cent benefited, and nearly half of the whole series were not benefited at all. On comparing these results from during-the-season treatment with the results from preseasonal treatment it is evident that for late hayfever by far the best results are obtained from preseasonal treatment, and it is questionable whether during-the-season treatment is even worth giving when it is taken into consideration that there are localities to which patients may go where ragweed does not exist.

Preceding and During-the-season Treatment with Pollens. Some patients present themselves a few weeks previous to their season of symptoms, that is, they apply for treatment too late for preseasonal treatment alone and too early for during-the-season treatment. Rather than let them wait until their symptoms begin and then give them during-the-season treatment, it is best to immediately begin treatment and continue the treatment on through their period of symptoms. This method of treatment yields better results than does the during-the-season treatment, but not as good results as the preseasonal treatment.

During-the-season Treatment with Bacteria. Occasionally when preseasonal pollen treatment fails, treatment during the season with autogenous nasal vaccine or a mixed streptococcus vaccine will benefit. The reason for such treatment is that it is quite possible that ragweed pollen exposure may in some cases

cause such a severe irritation of the mucous membranes that ever-present bacteria may, either alone or together with ragweed pollen, be a cause of hayfever symptoms.

Other Pollens That May Cause Hayfever. It has been shown in this paper that the chief causes of hayfever occurring in the New England States were the pollens of ragweed, timothy, and June grass; that an occasional cause is the pollen of the rose and redtop grass and of various trees. There is, however, almost an unlimited list of pollens that may at any time, but probably rarely, cause hayfever. Therefore those who treat a large number of hayfever patients and for those who fail to obtain satisfactory results from treatment with the common pollens mentioned it is advisable to have a very extensive assortment of pollens. As a rule, however, it would seem to be sufficient to warn the ragweed patients that they should not smell of golden rod, golden glow, sunflower, poppy, aster, chrysanthemum and the like that pollinate during the ragweed season. The grass cases may be warned to avoid close contact with clover, lilies, daisy, dandelion, rose, lawn grass, orchard grass, corn and the like that pollinate during the grass season. In certain localities in this country it may be necessary to treat with the pollen extracts of the various grains, with sunflower, sage brush or what not, but this necessity is not universal and is limited to the various localities where exposure to these particular pollens is unavoidable.

Other Parts of Plants That May Cause Hayfever. The leaves of certain plants and trees may cause hayfever. The under surface of some leaves has a fine hairy growth, and these fine hairs may cause hayfever. I have observed one patient who had hayfever from and was sensitive to the hairs of the willow tree leaf; treatment with an extract of these leaves prevented hayfever. Another patient was sensitized to and had hayfever from the plantain leaf. It is quite probable that the plane tree, the common shade tree in London, may cause hayfever. Such instances, however, are extremely rare and need not be considered as a rule.

Foods May Cause Seasonal Hayfever. Seasonal hayfever due primarily to foods has not come to my notice. However during their season many hayfever patients find that certain foods

aggravate their symptoms, whereas these same foods may be eaten without symptoms at a time when they are not accustomed to have hayfever, and they can eat the foods during their hayfever season provided they have had sufficient pollen treatment to protect them against the particular pollen that primarily causes their hayfever. These foods are usually the fruits, and they have no apparent relationship to the causative pollen. Among the usual fruits should be mentioned peach, melon, and apple. Green corn and the use of beer and wine often aggravate ragweed hayfever, but they do not aggravate grass pollen similarly. With the peach it is often the skin that causes trouble, whereas the pulp usually does not. The cooking of the fruits often renders them inert.

Animal Emanations May Cause Seasonal Hayfever. The patient who is sensitive to animal emanations usually has symptoms on exposure to the animal at any and all times of the year; occasionally, however, such a patient has symptoms only from exposure to the animal during the spring and summer when the animal is shedding, moulting, or perspiring profusely.

Bacteria May Cause Seasonal Hayfever. The possibility of bacterial infection as a complication of or secondary to pollen sensitization has already been discussed and the possibility of bacterial infection as a primary cause of hayfever in patients who are not sensitive to pollens must be considered. Each year I examine three or four patients who have seasonal hayfever but who are not sensitive to any of the pollens; therefore these patients are treated with their autogenous nasal secretion vaccine.

Pseudo-hayfever. I have already, under perennial hayfever, discussed the possibility of pseudo-hayfever which may complicate a seasonal hayfever as well.

Conclusions. Satisfactory preseasonal pollen treatment yields excellent results in seasonal hayfever. By satisfactory treatment is meant five or six treatments with a 1 to 500 dilution of the pollen extract, or, better still, two or three treatments with a 1 to 100 dilution of the pollen extract.

When preseasonal pollen treatment fails sometimes benefit results from during-the-season treatment with pollens and sometimes from during-the-season treatment with an autogenous

nasal secretion vaccine. During-the-season treatment with pollens without preseasonal treatment is not very satisfactory, although such treatment for the early type of hayfever is worth doing provided for some reason or other it is not possible to give preseasonal treatment.

Treatment that of necessity must begin late preseasonally may be continued on through the pollen season with better results than those obtained by during-the-season treatment alone, but with much less beneficial results than those obtained by beginning preseasonal treatment early enough to permit of its discontinuance before the season of pollination begins.

Although in the New England States the pollen of ragweed (dwarf variety) is practically always the cause of late hayfever (August and September) and the pollen of timothy grass is the cause of probably 90 per cent of the early hayfever (June and July), in other localities other pollens may play a great part in the cause of either type of hayfever. For this reason it is essential that other observers publish their tests, results, and treatment in detail in order to learn the causative pollens and proper treatment in various localities.

In the New England States the pollens of the rose and redtop grass occasionally cause early hayfever, and treatment occasionally has to be given with these. The pollen of June grass is a more or less common cause of early hayfever, but when the season of its pollination is very early, unless the treatment is begun very early too little treatment can be given with it to be of benefit, and when its pollination is very late, sufficient treatment with timothy pollen has been given to protect against June grass pollen exposure.

Treatment with a combination of timothy and June grass pollens was not successful in my hands because of insufficient treatment with both pollens; the addition of June grass pollen retarded the amount of treatment that otherwise would have been given with timothy alone. Another illustration of the undesirability of mixed pollen treatment is noted with those patients who have both the early and the late types of hayfever. In these cases, during the month of May and part of June, large amounts of timothy pollen extract should be given together with small amounts

of ragweed pollen extract, and the result in these cases is rather poor because there is a tendency to restrict the timothy treatment for fear of producing anaphylaxis from the combination of two pollens to which the patient is sensitive. In other words, treatment with a combination of pollens either diminishes the amount of treatment that is required with one or all of them or pushing the treatment with the combinations leads to the danger of anaphylaxis. For either or both of these reasons I see no benefit to be derived from mixed pollen therapy. As regards the early type of hayfever I consider it best to treat preseasonally with timothy or the chief causative pollen, and if necessary to treat during the season with June grass pollen.

Since intimate exposure to other pollens which may be attributing causes of hayfever—the eating of fruits during the hayfever season, the possibility that bacteria play a part in the cause of hayfever, and the exposure to olfactory irritants—may all aggravate the symptoms of hayfever, it is remarkable that hayfever treatment is as near perfect as I have tried to present to you.

# THE GENERAL TREATMENT OF THE ASTHMATIC[1]

FRANCIS M. RACKEMANN, M.D.

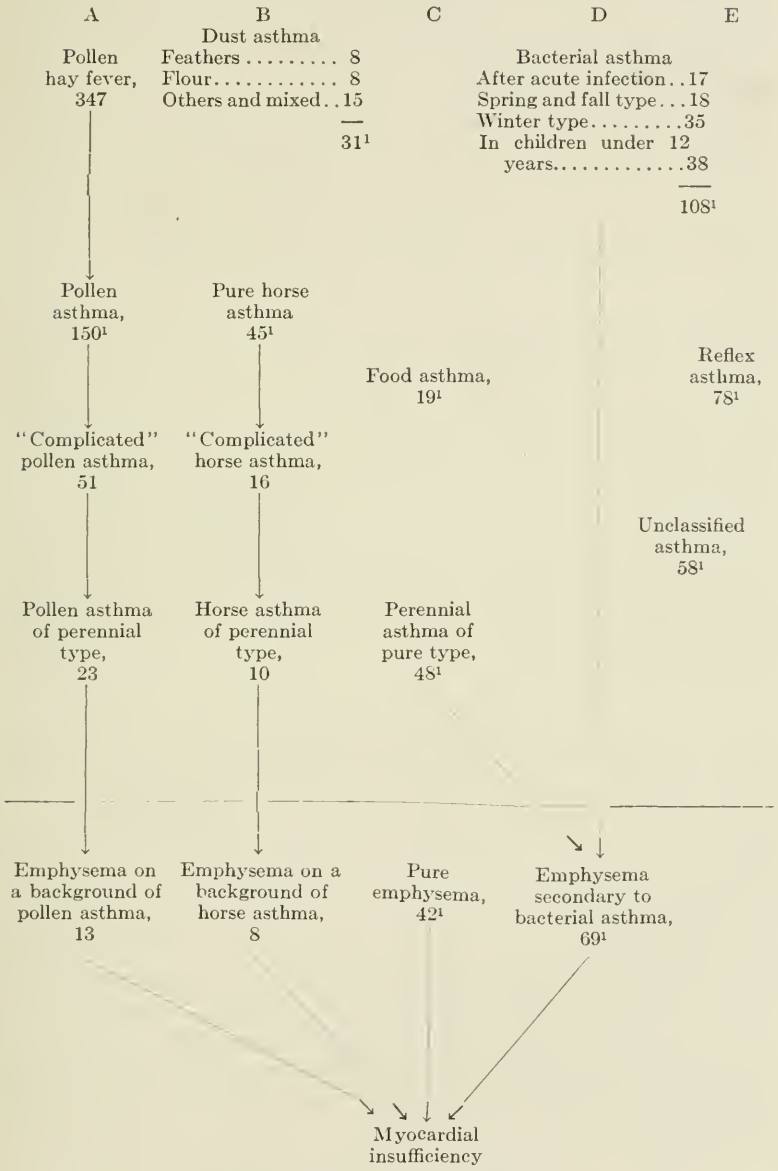
On asthma, hayfever and allied conditions there is an ever-increasing literature which emphasizes the importance of foreign proteins as a cause of the disease. While it is true that in many cases foreign proteins are the only cause, yet it is important to recognize that the general condition of the patient often needs treatment, and that in a few cases it is not foreign proteins but the general poor condition or perhaps some local pathology which is the underlying factor. It should be remembered that asthma is a symptom and not a disease entity and that it may be defined simply as a peculiar type of dyspnea.

It is obvious that there are many causes of asthma. The accompanying chart demonstrates not only the five important groups of causes but also demonstrates that the type of asthma tends to change and progress from an orignally pure type to a more chronic persistent type, which finally crosses the "line of organic change" to a type of asthma which is associated with obvious pulmonary emphysema and its accompanying chronic bronchitis. This chart has been found to be of definite value in the classification of patients in the clinic.

In the study of each patient the routine as carried out in the Massachusetts General Hospital is approximately as follows:

[1] From the medical services of the Massachusetts General Hospital.

A CLINICAL CLASSIFICATION OF 648 CASES OF ASTHMA




[1] New cases originating in this group.

First and foremost a careful history is taken on each case. It is remarkable how often the diagnosis of almost any of these groups can be made on the history alone, but such a history must be taken from a Sherlock Holmes point of view, and while taking it the classification above referred to must be kept in mind. For example, a patient with emphysema is seen perhaps in February. He says that his present severe and chronic type of asthma has dated not since last October, with the onset of cold weather, but since last August, while during the months of June and July he was fairly comfortable, although always short of breath on exertion. He will say that several years ago he was not so short of breath on exertion nor did he have much asthma after Christmas, and going further back he will very likely remember the time when his asthma was limited to the months of August and September. Beyond that he may remember that, as a young man, he had no asthma at all but did have hayfever, beginning in August and lasting until the first frost. The diagnosis is clear and it is obvious that a simple hayfever due to ragweed was the starting-point of the present symptoms. Such a history indicates the treatment which must be aimed at preventing the next attack of hayfever and pollen asthma. In the presence of emphysema probably no treatment will be entirely satisfactory.

A young school-girl, aged sixteen years, had asthma fairly constantly throughout the year for four or five years. There was one point in her story which was of prime importance: Last summer she went to the seashore, where during her two weeks' stay she was absolutely free of all coryza and asthma. The first night at home she again had trouble. She was later found to have horse asthma.

Another woman, aged thirty-five years, had asthma in fairly typical isolated attacks at all seasons of the year, between which she was comparatively well and free from all symptoms. In her case there was no way of discovering any cause by the history, but by the second method of study, namely, the skin test, a positive reaction to wheat was found, and on advice to give up cooking with wheat flour she has since remained entirely free of symptoms.

Skin tests may be misleading in at least two ways:

First, they may be entirely negative when the history is positive. Coming back to the school-girl with horse asthma, skin tests done by the cutaneous method were entirely negative. When her country home was visited the barn was found to connect directly with the house, to contain four horses, and to be dirty and dusty. Since a diagnosis of horse asthma would have explained her condition, further tests by the intradermal method were made which ultimately established a positive reaction to horsehair extract. Treatment with this extract has brought about considerable relief.

Secondly, skin tests may be misleading by being positive when the history is entirely negative. The finding of a beautiful test to wheat, oat and other cereals in a diabetic who had not touched any cereals for several years was of intense interest, and it is quite frequent to find patients with early hayfever who give a test to ragweed, and even more frequent to find patients with late hayfever who give not only a positive test to ragweed but a test to the hay pollens as well.

The third method of study is often of greater importance than the other two. It is essential to examine patients physically and completely. The importance of this is shown by the fact that about 12 per cent of cases of reflex asthma were recognized in this series. These cases included fifteen children in whom the only method of treatment consisted in efforts to improve their malnutrition, bad hygiene or improper methods of feeding. In all fifteen the asthma has been markedly improved.

Two patients had a positive Wassermann reaction. One was treated with arsphenamin and improved; the other had not returned for treatment and was unimproved. Two patients with visceroptosis have had no asthma since wearing a proper abdominal belt. In January I saw a small boy of ten. Asthma had existed since infancy, and in addition he suffered from attacks of syncope and convulsions, strongly suggesting epilepsy. After putting him on a very rigid daily régime with plenty of corrective exercise for a month the epileptiform seizures had practically disappeared. He had gained one inch in height and several

pounds in weight, and his asthma, while not entirely gone, was improved to a marked degree without special treatment of any kind.

Cases of cardiac asthma are likewise not uncommon. Myocardial weakness, as manifested by rapid, often irregular pulse, low blood-pressure, marked dyspnea on exertion and swelling of the ankles, is frequently associated with and may be caused by emphysema and chronic bronchitis. It is characteristic of patients with cardiac asthma that rest in bed promptly brings about relief. Such patients ordinarily sleep well and do not have the nocturnal attacks which are so distressing and so characteristic. Pulmonary tuberculosis is not an infrequent cause of asthma of the chronic persistent type.

A local examination of the nose and throat by a specialist should form part of the routine examination of every case. Such an examination should be undertaken from several points of view:

1. There is always a chance that some definite pathology in the nose or its sinuses or in the tonsils can be recognized and that later on this pathology can be proved by its removal to be the underlying cause of the asthma. This happens in a few cases. For example: A female, aged twenty-six years, had had severe and almost constant asthma for ten years. Her tests were all negative, and in the hospital ward she continued to have severe attacks in spite of all treatment, and was discharged in poor condition. Later, in the outpatient department, a pansinusitis was recognized, and following a left Killian operation she was free of all asthma for nearly six months, and then, following a slight return of her symptoms, the other side was similarly drained, and today she is having some asthma but in very mild form and the hope of curing her is reasonable. She has gained nearly twenty pounds in weight.

2. In case a focus is recognized its removal constitutes the only method of investigating its importance. Furthermore, whether such removal brings about a sudden relief to the asthma or not, there is little doubt in the author's mind but that the removal is often important in improving the general condition of the patient.

3. In a recent paper Tobey[1] brings out the important fact that the appearance of the mucous membrane of the nose in vasomotor rhinitis and in asthma is characteristic in that it is frequently possible to tell by this local appearance whether or not foreign proteins in dust are an important causative factor. It is therefore important that the mucous membrane be studied in each case.

From a practical point of view it is of interest to look back over the records and see how often this local nose and throat examination has been of value. The replies to a recent questionnaire give some information. As a result of the original study, only 43 patients of all types were advised to have some local operation on the nose and throat. As a result of the operation 26, or 60 per cent, reported as being very much improved, and in 25 this was the only treatment.

On the other hand it is quite remarkable how often patients have had some local operation performed without much improvement. Thus in this particular series of 369 patients local operations on the nose had been previously performed in 83 cases (22.5 per cent) and on the throat in 17 cases, 12 of which latter were for the removal of tonsils and adenoids.

If the number of these previous operations is checked with the particular type of asthma it is curious that about 25 per cent of all asthmatics in each group had been previously operated and that there is little or no variation in this figure according to the type of asthma. It is obvious, therefore, that local treatment does not by any means lead always to success.

In conclusion, I would plead that each patient with asthma be studied from every point of view. I would emphasize the importance of great care in history-taking and in general physical examination.

I would call attention to the fact that although many needless operations on the nose and throat of asthmatics are performed, yet at times these operations are followed by spectacular results, and that the percentage of these results will be greater as the study of the patient as a whole has been more thorough and complete.

[1] Vasomotor Disturbances of the Nasal Passages, 1922. To be published.

## Discussion on the Papers of Drs. Goodale, Walker and Rackemann

Dr. Emil Mayer, New York:

I should like to ask Dr. Walker to let us know whether the solutions of these pollens keep indefinitely? In other words, can he use a solution of a pollen made this year for next year?

Dr. Henry L. Swain, New Haven, Conn.:

It may be of interest to Dr. Rackemann to learn that some twenty-five or thirty years ago, in my youth and innocence, I wrote a paper entitled, "Asthma: Its Intranasal Origin and Surgical Treatment," and at that time I grouped together a lot of cases I had seen, and said that "about 70 per cent had been practically cured by intranasal treatment." Your estimate, I believe, was about 60 per cent. The observation at that time seemed to me convincing that if we only gave enough attention to asthma in the intranasal way that we could cure all of them. Now the thing has broadened out into a tremendously wide field.

I would not have dared to suggest the case that I have now in mind had not Dr. Rackemann commented in a similar way. A patient of mine, after much thought and investigation, discovered that his asthma only came on when he danced with blondes. He could dance with brunettes with impunity. Finally, it was found that it was due to a face powder used by the blondes; he was promptly desensitized, and that settled the whole situation.

Dr. John E. Mackenty, New York:

It is interesting to note how our views have crystallized in the last few years on the question of vasomotor rhinitis. It was not so many years ago that cauterization was our chief therapeutic asset. I remember a rather amusing incident which happened in one of the clinics of the Manhattan not many years ago. One of the assistants asked the chief surgeon what he would do for vasomotor rhinitis. The chief surgeon asked him, "Did you cauterize the nose?" "Yes," said the assistant. "Did you use cocain?" The assistant said, "I did." The chief said, "The next time you cauterize the nose omit the cocain, then you will not be bothered with the patient any more." That was about the attitude of most of us on the question of vasomotor rhinitis. It was several years ago that I began to operate on some of these cases,

and the results were sometimes so gratifying that I felt that vasomotor rhinitis was an ethmoidal disease and not a nervous disorder. The operations were done empirically at first, consisting of removing the ethmoid labyrinth. Later I found that opening the antrum added materially to the benefit in these cases. Also, in the antrum of many of these cases there was a peculiar viscid soapy-like material. It was not pus. In regard to vaccines, I have used them quite extensively in vasomotor rhinitis, at first in cases that did not seem to be bad enough to require operation and in those who refused operation. In quite a few cases autogenous vaccines cured the condition, but there is no question that operation first and vaccines afterward give a much better result. Here be it noted I am speaking not of vasomotor rhinitis due to external causes such as pollen, etc. I had three cases this winter with apparent cure by removal of the tonsils alone, one quite remarkable case which had severe rhinorrhea and asthma. The tonsils were removed and no attack has since occurred. I have been very much interested in the papers of Drs. Rackemann, Walker and Goodale. I think for a classical exposition of the subject and for clear expression these papers are well worth hearing. I have never heard so much so concisely said and so well said on this subject. I am very glad that I was fortunate enough to be present. These three papers do enormous credit to our Boston colleagues. They form a unit and place the whole subject squarely on a scientific foundation.

Dr. Max A. Goldstein, St. Louis, Mo.:

In the large class of cases of vasomotor type that are reported cured by proteids or pollens I should like to ask how long the immunity lasts; whether desensitization must be frequently repeated; and whether a sensitization test without reaction is an absolute guide to immunity?

Dr. Gordon Berry, Worcester, Mass.:

Dr. Walker points out that foods the patient is fond of may produce attacks. I recall a case where the patient disliked a food and had to force himself to eat it. He finally discovered that eating this food was always followed by a gastric upset and a "cold." Sensitization tests showed this food to be poisonous. I should like to ask Dr. Walker whether a child's persistent dislike for a food may not be nature's instinctive warning as to which foods are poisonous?

Dr. William B. Chamberlin, Cleveland, Ohio:

Supplementing the question which Dr. Mayer asked, I should like to ask Dr. Walker what his experience has been from the use of stock pollen extracts put out by the various commercial organizations? I realize Dr. Walker prepares his own extracts.

Dr. Greenfield Sluder, St. Louis, Mo.:

I want to add my sentiments to Dr. Mackenty's statements concerning these papers. I would, however, include Dr. Goodale's paper with the other two.

This has been a subject I have been very much interested in, and I have tried to follow these gentlemen's work. I have not the material, I never have had the material, that these gentlemen have had, and what I am to say must be taken with that in memory. Asthma as a nasal reflex is the chief thing that has interested me. It is my habit to send asthmatics to the internist to eliminate the other possible causes before the nasal treatment is taken up, which is somewhat at variance with Dr. Rackemann's observation that they had all been operated on in the nose first. Asthma as a nasal reflex seemed to me almost uniformly a manifestation on the part of the sympathetic, that is, from the nasal (sphenopalatine, Meckel's ganglion) or the sphenoid. I have not had the cases to discover the antrum or the ethmoid as the cause of the asthma. I do not mean by that to in any way challenge the observation of the essayists.

Much is said today about asthma, but as far as I could make out from my listening there is no explanation of how the asthma arises. Three years ago, at the American Medical Association meeting in Atlantic City, I gave some speculation on the production of asthma as a nasal reflex, and I cited some cases in which asthma could be produced by mechanical or chemical irritation of the nasal ganglion. In a patient reported at that time I repeatedly produced asthma by the application of silver nitrate solution over the sphenopalatine foramen, almost submucous to which the ganglion lies. I injected the ganglion and for some five years now she has been free of asthma. The question of how the asthma is produced (drawing on the blackboard): The nasal ganglion lies almost submucous to the membrane covering the sphenopalatine foramen; the sphenopalatine foramen is uniformly (almost with mathematical precision) located posterior to the posterior tip of the middle turbinate. This then will be the sphenopalatine foramen (blackboard). As you recall the anatomy, most of which I will omit as the blackboard is too short, this is to represent the lower cervical

ganglion. The sympathetic supply for the nasal ganglion winds around the carotid artery and finally lands in the nasal ganglion as the great deep petrosal. The origin of the sympathetic for the nose is the lower cervical and the first and second thoracic nerves, as I recall it. These thoracic nerves cast off the fibers which eventually become the sympathetic supply to the neck and head. They ascend normally to be relayed in the upper cervical ganglion, that is as preganglionic neurons. They rise here (blackboard) and pass upward, the first break being in the upper cervical ganglion. There are encountered multipolar cells, and, as postganglion neurons rise, the fibers which eventually land in the nasal ganglion. It is a matter of speculation then as to how you can have nasal asthma in some persons and not in others by the same exciting causes. From the third, fourth and fifth, and it seems to me, as I recall it, the sixth and seventh thoracic nerves, cast out the sympathetic fibers which run up to the lower cervical ganglion and there dip down to go into the chest as vasomotor fibers for the lung and cardioaccelerator fibers. For speculation, imagine a reflex starting in the nasal ganglion and an anomalous arrangement of these fibers. Think that the fibers for the nasal ganglion instead of being relayed in the upper cervical may be relayed in the lower cervical and assume afferent attributes for the sympathetic. This is in absolute contradiction to the statements of the great workers with the sympathetic, Langley, Gaskill, and Anderson, that the sympathetic system is an efferent system only. You may think of it as having afferent attributes from the fact that cells making up a sympathetic ganglion wander out from the central system, some of them coming out of the spinal ganglia, and must needs be afferent in their attributes. Suppose we reverse the current in the sympathetic for this speculation and assume that the impulse can start in the nasal ganglion and proceed to the lower cervical ganglion instead of being relayed in the upper cervical ganglion, which must be considered the normal arrangement of fibers. In the lower cervical ganglion are met the fibers from the thoracic sympathetic, which ascend as preganglion neurons to the lower cervical ganglion; from thence they range downward to enter the chest, they being vasomotor for the lungs and accelerator fibers for the heart. The transfer of the impulse from one set of fibers to another within the ganglion may take place by virtue of the cells of Dogiel, type 2. In speculation this mode of transfer of impulse does not seem to be impossible and serves as a plausible explanation of asthma in the nasal reflex. On one occasion I was trying the anesthetic effect of menthol locally. The

patient had at that time a sphenoidal headache, and I filled the sphenoidal sinus with 2 per cent solution of menthol and exploded as severe an attack of asthma as one can well picture. That then is a chemical irritant to the mechanism. That is in the class with the other case where I could irritate the nasal ganglion and produce asthma by rubbing with a cotton applicator, or application of a silver solution, which she did not tolerate, and is the explanation I fancy of why we can get results from the postsphenoidal district. May be my attention has been centered there and may be I have overlooked the antrum. I have had three of these, one patient in particular, who has the most violent autumnal hayfever with very severe asthma. I found that I could stop that asthma uniformly by the application of cocain to the nasal ganglion district and therefore I injected it. I explained to the patient that the injection of the nasal ganglion was not a severe ordeal and well worth the trial. She accepted it and the hayfever came on the accepted day, August 15. It was "exceedingly mild," however, according to her expression, and the asthma was omitted. The injection of that case stopped the asthma for three years. It did not stop the hayfever; she had mild hayfever with increasing intensity from year to year, and it took the fourth year before the reflex arc reappeared to make asthma. I injected again and again, getting that result. I had tried her with pollen of ragweed extracts subcutaneously, and it had failed. I have three of these cases. Dr. Goodale spoke of various toxins. In this particular patient, on one occasion she had had a cold in her nose which did not seem to be unusually severe, but that particular cold exploded the asthma in midwinter. It has seemed to me for a long time that there is a variety of toxins produced from a variety of organisms and that they are not always from the same clinical phenomena. This particular nose is non-suppurative and cultures from it have been negative. In this patient in midwinter, with snow on the ground, I applied a strong solution of pollen and produced the asthma by that application of pollen extract to the nasal ganglion.

I am delighted to have Dr. Walker's definition of hayfever and his explanation of the perennial type. I had never thought of it that way. I had thought of the perennial hayfevers as local irritants, they being either a hyperplastic sphenoiditis, that is, without pus, or as sphenoiditis with pus. In the course of Dr. Walker's paper the question arose, Why did some of the patients have hayfever only and why did some add asthma to the symptom-complex? I believe that the sensitiveness of the sympathetic system varies. Possibly it is explained

by just what I have said concerning this one particular coryza in this patient; possibly the sympathetic was more sympathetic than at some other time; but be that as it may, the variation is certainly well marked. Sometimes they will explode with the asthma without anything else, and at other times with perfect classical "lower half headache."

Asthma may be produced in various ways. I heard of a case since I have been here where a patient had an inguinal hernia and asthma. The inguinal hernia, for some reason, had been delayed and was finally operated and the asthma was cured. Later on an inguinal hernia developed on the opposite side and the asthma reappeared. That can be, I think, only sympathetic transmission. In his monograph a few years ago Brown summed up a most comprehensive abstract of asthma from all causes. I recollect very clearly two or three of the cases: one type was a foreign body in the bronchus which was finally coughed up and proved to be a buckshot, after which the asthma stopped.

Dr. D. Bryson Delavan, New York:

This fine symposium recalls the time in the early history of the Association when those pioneers in the study of hayfever, Daly, John MacKenzie, Roe, Harrison Allen, Solis Cohen and others, were contributing their epoch-making work. It is certain that today another milestone in the progress of our knowledge has been passed.

The first instance of coryza caused by sachet powder that I had observed was in the case seen many years ago of an infant, strong and vigorous, six weeks old, in which exaggerated symptoms of hayfever were caused by violet powder used to perfume his layette. Upon the removal of the powder the coryza quickly vanished. Soon after this observation a lady consulted the speaker giving a similar history, and with the discontinuance of the violet powder a like successful result was obtained.

Dr. Paul Carton, attending physician at the Hospital at Brevannes, near Paris, France, has recently published a treatise entitled *Traité de Médecine, d'Alimentation et d'Hygiene Naturistes* which contains some interesting ideas in connection with the study and treatment of hayfever.

Dr. Joseph L. Goodale, Boston, Mass. (closing):

I should like to take the opportunity of asking Dr. Walker if he has made any observations to determine whether the disturbances produced from willow leaves are anaphylactic in character or due to the mechanical irritation from the leaf hairs?

In regard to the collection of pollens, we must remember the possibility of contamination. For instance, if one gathers pollen of the plantain from plants surrounded by grass, grass pollen may be adherent to the anthers of the plantain, and our inferences as to sensitization to the plantain may consequently be erroneous.

Dr. Walker (closing):

With reference to the subject of the pollen solutions, the first question asked, we find that the solutions at times deteriorate each year. The greater the dilution the more the deterioration. It is quite possible to keep a concentrated solution like 1 to 100 perhaps two years and get fair results, but we do not do that. We keep our pollen as gathered in a powder that will keep indefinitely. From that powdered pollen we make extracts each year, thus avoiding holding them over. The gentleman asked about a dislike for common food. I think that is my greatest help in children. I always try to get some history from the mother that the child disliked the food, and I would almost say nine times out of ten the food that the child disliked and was forced to eat was the cause of the trouble. Often the child is punished when he first refuses to take eggs. The child refuses them at first through instinct. The mother recognizes later, on recalling these matters, that the child did not like eggs; through repeated punishment the child is forced to eat eggs. Sooner or later it is evident that eggs do upset the child. The adult does not seem to have retained or developed this animal instinct. In reference to Dr. Goodale, I would say that it was the protein in the hairs on those leaves that caused trouble, since macerating these hairs and extracting what we call protein from them, we call it protein because it gives protein tests. It may be a toxin as well, and giving extracts in dilution protects, and in this extract there is no hair. Therefore the treatment does not consist of anything that could mechanically irritate, and although the mechanical irritation may help sensitization, that is the bristles and spurs may help these things to stick in the mucous membrane, I feel that it is really the protein in the hairs that is the cause. Always when I use the word sensitization I would rather prefer to say idiosyncrasy, but as anaphylaxis fits in with the theory, until we know some better word I think we had better stick to what has been shown us in the past.

In regard to the stock pollen extracts: In past years results were not very good because they grouped the pollen, as I have already mentioned. They were treating autumnal hayfever with a solution of ragweed, sunflower, golden rod, and even daisy, which pollenates

in July. They were making polyvalent solutions, whereas what the patient needed was ragweed, and was getting three or four things which were keeping down the dose of the thing they needed. Now through the efforts of the government, commercial houses are putting out extracts of the individual pollens.

Dr. Rackemann (closing):

I cannot resist the opportunity of expressing my appreciation to Dr. Sluder for his remarks. We are tempted to think only of the exciting causes of asthma and overlook the fact that there is a fundamental basic cause of asthma about which we know almost nothing. This same basis should apply to hayfever, urticaria, etc., which are probably in the same biological group. In other words, there must be some method of explaining why certain individuals have hayfever and other people do not. Various thoughts occur in this connection: for example, one thinks of some endocrine-gland disturbance, but when we see the various types of people who have hayfever and when we see myxedema and goiter patients with asthma, such a thought is almost absurd.

Another theory is that asthma depends upon some abnormal tone through the great vagus or through the sympathetic system; but recently Mackenzie, of New York, has tested asthmatics with repeated injections of pilocarpin on the one hand and with adrenalin on the other, and finds that approximately equal numbers of asthmatics react to each drug without any constancy.

Finally, we must remember that asthma is a symptom; that it occurs in cardiac disease and may even be due to a foreign body in the larynx. I remember one patient with a tumor of the larynx. It was found to be a gumma, and antisyphilitic treatment cured the tumor and cured the asthma. Dr. Sluder's theory is very attractive, and by it we can explain a large majority of the cases, I think. As regards the hernia operation, I would call your attention to the fact that ether anesthesia given to almost any case will result in definite relief of the symptoms for some time, but this relief is usually only temporary. Furthermore, infectious diseases of definite severity often bring about a relief of asthma for a time. This seems to be true mostly of respiratory infection either of the head or the chest. It would fit in with Dr. Sluder's reflex theory if we could show that not only do foreign proteins inhaled through the nose act on the nasal ganglion, but that ether anesthesia and respiratory infections produce their effects in the same manner. I am very glad indeed to have heard Dr. Sluder.

# INFECTIONS FOLLOWING TONSILLECTOMY UNDER LOCAL ANESTHESIA

GEORGE B. WOOD, M.D.

One of the surprising features of tonsillectomy is that in spite of the impossibility of making and keeping the operative area sterile there are few serious cases of sepsis following it even though every tonsillectomy wound does show some infection in that there is a bacterial invasion of a certain amount of tissue with an inflammatory reaction greater than is necessary for the mere healing of the wound. That serious infections are not more common is due to the open nature of the wound affording free drainage, to the mechanical action of the saliva in washing away the bacteria, and probably also to its germicidal action. Cases of serious septic conditions following tonsillotomy and tonsillectomy under ether have been reported, but it has been my fortune to have been spared the tragedy of a septic fatality from tonsillectomy, nor do I personally know of a fatal case of local sepsis when the operation was done under general anesthesia. Up to last fall, when the following case came into my experience, I could have said the same thing also in regard to tonsillectomy under local anesthesia.

L. M., female, married, aged twenty-four years, was admitted to the surgical service of the Howard Hospital, October 23, 1921, for phlegmon of the left side of the neck. For the early history of the case I am indebted to Dr. George M. Coates. This patient was admitted to the Medico-Chirurgical Hospital for a tonsillectomy, October 15, 1921. She brought with her a note from her physician stating that he would attend to her postoperative care, and if she stood the tonsillectomy well he requested that she be permitted to return to her home at once and not be kept in the hospital overnight.

She gave a history of having had several attacks of tonsillitis each winter and had been troubled with an irritation of the throat for the past summer and up to the present time. Her general condition

was fairly good. The examination showed tonsils that were pale in color and greatly hypertrophied. No anomalous vessel could be seen or palpated. The crypts of the tonsils contained cheesy, bad-smelling material, and her temperature, was 98.6°.

*Operation.* The tonsils were painted with a 10 per cent cocain solution, which was followed by a coating of one-half strength tincture of iodin. Four drams of ¼ per cent novocain and 4 drops of adrenalin (1 to 1000) were then injected behind the capsule of each tonsil, the needle each time being inserted between the anterior pillar and the tonsil. The tonsils were removed by the eversion method with a snare and the entire tonsil and its capsule were removed at the first attempt. Good anesthesia and hemostasis were obtained, and she was a model patient. She remained in the hospital about two hours, and as there was no sign of hemorrhage or other trouble, she was permitted to depart for home as per her physician's request. With this ends Dr. Coates's knowledge of the case.

She was admitted to the Howard Hospital, October 23, with a history that on October 20 the left side of her neck began to get stiff and very painful. The swelling at first was very slight but gradually increased, and the pain in the throat became almost unbearable.

She had been married about four years and had had no children and also no miscarriages. She worked as a chambermaid.

On admission her temperature was 102°, pulse 120, and respirations about 35. Her urine showed a distinct quantity of albumin, negative for casts, containing numerous leukocytes and erythrocytes.

The physical examination showed a well-developed negress of about twenty-five years of age. Her pupils were normal and nose and ears negative. There was a hard, brawny swelling of the left side of the neck, most marked just beneath the mandible. The heart was normal and there was no evidence of any involvement of the lungs. She was operated on under ether by the chief surgeon of the hospital on October 25. An incision was made along the anterior border of the sterno-cleido-mastoid muscle. The lymph nodes were found hard and enlarged, but there was no pus present. A rubber-dam drain was inserted and the wound left open.

On October 29 the patient was first seen by the laryngological service. Dr. Hunter, my assistant, saw the patient on that day and reported the following condition of the throat: There was marked swelling in the region of the posterior pillar of the left tonsil, which when incised showed a large cavity, but there was no pus or other contents. Dr. Hunter believed that it had either ruptured spontaneously or was draining through the external incision in the neck.

At this time there was a free drainage of very foul pus from the external wound. I saw the patient on the following day. She was very toxic, scarcely able to swallow, and refused all nourishment. Temperature 101°, pulse about 100, and respirations about 25. Her temperature since admission had been running a fairly regular course with a tendency to drop. The external wound was at this time draining very foul pus and a large slough had been removed. On examination of the throat a small remnant of the left tonsil was seen in the upper pole, and back of this on the lateral pharyngeal wall was the cavity described by Dr. Hunter. At the lower pole of the tonsil there was a foul, sloughing area through which the probe could be passed directly into the abscess cavity of the neck. At this date the resident physician told me that he had observed when dressing the external wound that if the patient coughed, bubbles of air made their appearance at the bottom of the wound. The leukocyte count about this time was 23,600, with 89 per cent polymorphonuclear leukocytes; 3 per cent large mononuclears; 4 per cent small mononuclears; 1 per cent eosinophiles; 1 per cent basophiles; and 2 per cent transitionals.

November 2 the drainage from the external wound was still very copious and several more sloughs were removed. There was regurgitation of water through the nose on attempts at swallowing, and she still refused nourishment. Temperature 100°, pulse 100, and respirations 23.

November 3 the patient seemed to be improving. The drainage from the external wound was not so marked and there was less sloughing. Temperature 98.4°, pulse 100, and respirations 22.

November 4 the patient seemed much better and was beginning to take nourishment. About one o'clock, after having eaten her dinner and saying that she felt better, she suddenly began to bleed profusely from the mouth and nose and external wound, and she died before the resident physician could reach her bedside. No autopsy was allowed.

It is evident that some large bloodvessel became involved in the destructive process in the neck, whether carotid or other vessel it is, of course, impossible to state, though the absence of a septic temperature is rather against the idea of veinous involvement.

This case naturally opened the question in my mind as to the increased possibility of serious local infections following tonsillectomy when done under local anesthesia. As my experience

with local anesthesia in tonsillectomy is not very great I inquired of my colleagues in Philadelphia, especially those who were doing large numbers of cases under local anesthesia, and I found that the case reported was by no means unique.

Dr. George M. Coates has kindly given me permission to report the following cases and furnished me with their histories:

Case I.—Male, aged twenty-seven years. Had a tonsillectomy under local anesthesia, obtained by painting with 10 per cent cocain solution and injecting 0.5 per cent novocain solution back of the capsule by several punctures through the tonsil. Careful asepsis in technic. The patient did well after the operation and returned to outdoor work in three days. On the sixth day after the operation the right throat became very sore. There was no external swelling and internally there was only a very slight swelling of the base of the right posterior pillar. This contained two or three drops of very foul pus, and that was all that was ever found. Sepsis progressed, however, the fever going to 105.4°, and he died on the eleventh day.

Case II.—Male, aged twenty-eight years. Had his tonsils removed under local anesthesia, quinine-urea hydrochloride being injected beneath the pillars. He developed on the second day an abscess in the supratonsillar fossa, from which he recovered after it had been incised and drained.

Case III.—Male, aged twenty-six years. Had a tonsillectomy under local anesthesia with poor aseptic conditions. Anesthesia was obtained by infiltrating the pillars with one-tenth of 1 per cent solution of cocain and adrenalin. On the second day he developed a slightly irregular fever and had some swelling of the right side of the neck. There was no swelling internally. On the fifth day he suddenly became cyanotic but recovered after a quantity of pus was removed from his throat. Later in the same day a tracheotomy became necessary, but in spite of this he died early the next morning. At the autopsy a moderate-sized abscess cavity was found in the low lateral wall of the pyriform sinus, but the place of rupture was not discovered.

Another case I am reporting at the courtesy of Dr. Samuel Cohen.

This was a man operated on May 6, 1921, under local anesthesia, about two drams of ½ per cent novocain being injected. On the third day pain and tenderness began on the left side of the neck and ten days after the operation a swelling was incised externally and a large quantity of pus evacuated. This patient made a good recovery.

I am indebted to Dr. David N. Husik for the history of the following two cases:

M. S., a native of India and a student in the dental school, was admitted to the students' ward of the University Hospital for a local tonsillectomy on December 23, 1921.

Operation 3 P.M. on the same day. The anterior pillars and the base of his tongue were painted with a 10 per cent cocain and 4 cc of ½ per cent novocain were injected into each tonsil through the anterior pillar at about its middle third and back of the capsule. Only one injection in each tonsil.

The tonsils were very large and were easily removed. Dull dissection, inverted U incision and Tyding snare. The patient lost about two ounces of blood from each tonsil, was returned to bed and an ice-collar placed around his neck. He was discharged the next day with the usual sore throat.

December 27, he returned to the dispensary complaining of severe right-sided sore throat and stiffness of the muscles of his neck. One of our assistants painted the wounds with argyrol and advised him to gargle his throat with hot salt solution.

December 28 I saw him and he looked very sick, could not swallow, and his neck was very tender. He was readmitted to the students' ward. On admission his temperature was 101° and pulse 96. Dr. O. H. Perry Pepper went over his chest and gave a negative report. The next day his glands on the right side became more prominent; he had great difficulty in swallowing milk and he looked septic. There was no change on December 29. He had me worried on December 30 because he seemed to be getting worse and could barely open his mouth. That evening he had a chill and his temperature went up to 104.5°, and in playing around his supratonsillar space with a cotton-tipped applicator I got into an abscess. I then made several incisions and got a foul, greenish pus. The next day he was very much better, and under local treatment he steadily improved and was discharged January 6. There was still some cervical swelling and pain on swallowing, and the patient informed me the other day that his throat

did no begin to feel normal until a month after his discharge from the hospital.

A second case I had was a woman, aged about forty years. The same method was used as in the above case. She developed a severe right-sided sore throat and cervical enlargement on the fourth day after operation. She was treated with hot gargles and local applications, and several days later she spat up an enormous amount of pus and was instantly relieved. Her throat looked like a peritonsillar abscess. She was a ward case on the service of Dr. Stengel, but I do not remember her name, so I have not her history of the case.

A rather curious case was seen by Dr. George Fetterolf during his service in the army.

A soldier who had had his tonsils removed under local anesthesia was seen by Dr. Fetterolf shortly after the operation. He had a swelling of the posterior and lateral pharyngeal walls which resembled a retropharyngeal abscess. This was opened and a quantity of pus evacuated. The case, however, did not heal up, and on further investigation a second opening was found leading posteriorly into a second abscess cavity. When the second abscess cavity was opened up the patient made a rapid recovery. From his description of the case it would seem that there was an opening through the prevertebral fascia.

The cases reported in the current literature of abscess following local tonsillectomy are not quite as frequent as I would have supposed, judging from the number I have heard of in Philadelphia, yet they are sufficiently numerous to show that this menace of sepsis is a possibility real and to be feared.

L. W. Dean[1] has made a careful survey of the literature up to 1910 and reports 3 cases from his own experience of severe infection of the neck: 2 of them following local anesthesia and 1 presumably from local anesthesia, though this is not distinctly stated.

In the first case there was severe hemorrhage at the time of the operation and the patient rapidly developed marked enlargement of the glands of the neck. Rapid general sepsis supervened, with death on the sixth day.

In the second case a phlebitis of the internal jugular developed with extension of the thrombosis upward, involving the orbital veins of the left side and possibly also the left cavernous sinus. In spite of this very serious condition the patient finally recovered.

In the third case there was a phlegmon of the side of the neck, from which the patient finally recovered, though only after a very serious illness and extensive external operations.

D. A. Vanderhoof[2] reports a case of a man, aged twenty-three years, operated on in perfect health. Thirty drops of 2 per cent novocain and 1 to 10,000 adrenalin were injected into each tonsil. In this case the abscess apparently developed in the pharyngo-maxillary fossa and required an external incision. The patient, however, finally made a good recovery.

A. Soontag,[3] quoted by Charles W. Richardson,[4] reports the case of a boy who two days after the operation developed a left-side torticollis and died from general sepsis on the eleventh day.

H. L. Baum[5] reports 4 cases of local infection following deep injections. In 3 of these the infection resembled a peritonsillar abscess and in 1 there was a suppurative cervical adenitis. He is so convinced of the danger of the possibility of deep injections carrying sepsis into the tissues that he has discontinued their use.

Dr. Ira Frank in his discussion of Dr. Matthews's paper on "Tonsillectomy with Local Anesthesia,"[6] said that he had been in the habit of injecting the tonsils by passing the needle through the crypts just behind the capsule, but in 2 cases had had a deep cervical abscess on each side; and in his closing remarks Dr. Matthews himself admitted that he had had infection of the deep tissues occur a few times. Dr. Thompson in the same discussion called attention to the danger of injecting through the tonsil and said he had seen one case which almost resulted fatally from a deep infection of the neck.

Ever since I first saw a tonsillectomy done under local anesthesia by deep injections I have been fearful of the possibility of producing infection of the deep structures of the neck, so much so that I am afraid I do not obtain as good anesthesia as some of my colleagues, because I hesitate to plunge the needle deep in back of the tonsil. Just a few weeks ago I saw in consultation

with the operator a severe case of infection of the palate following tonsillectomy under local anesthesia. The operator was an extremely skilful surgeon and has done literally thousands of tonsil operations. In discussing this case he said: "I do not believe the needle could have penetrated the superior constrictor, as I never inject deeply. I prefer to let the patient have a little pain." I might add that this case recovered promptly because the injection did not penetrate through the constrictor muscle.

The regionary infection which may follow from infiltration of the tissues in the region of the tonsil can be of three types:

1. The infection may begin in the tissues internal to the superior constrictor muscle, including the palate and the faucial pillars. This would lead to a condition resembling peritonsillar suppuration, and though productive of considerable discomfort is not apt to be followed by a fatality.

2. If the needle penetrates through the superior constrictor muscle, which can be easily done if the injection is made deeply through the anterior pillar of the fauces, the infection then starts in the pharyngomaxillary fossa, the importance of which fossa as a serious location for suppurative processes has been so well shown by Mosher.[7] To refresh our memories the pharyngomaxillary fossa is a funnel-shaped space, bounded internally by the superior constrictor muscle, externally by the ascending ramus of the jaw and internal surface of a portion of the parotid gland, and posteriorly by the prevertebral fascia. Its base is upward against the base of the skull and its tip is continued downward by the carotid sheath. It is divided into two compartments by the styloid process and the attached muscles. The larger anterior chamber is in close relation with the tonsil and is separated from it by only the superior constrictor muscle. This muscle having a part of its origin as far forward as the internal oblique line of the lower jaw can easily be penetrated by a needle passing through the anterior faucial pillar. Abscesses starting in this fossa tend to perforate the lateral wall of the pharynx but may follow the carotid sheath downward and open into the larynx, esophagus or possibly the pleura.

3. An infection of the first or second types usually produces an adenitis of the deep nodes of the neck which are situated on the external surface of the carotid sheath.

The extension of pus collections in the various tissue planes of the neck is influenced by the layers of the deep fascia, but McClellan is partly right when he says, "Much undue weight has been given to them (the layers of the deep fascia) in this respect, for they do not by any means always set up efficient barriers against or form natural passage-ways for the course of pus as usually described." An abscess, however, posterior to the prevertebral fascia may descend into the chest, reaching the posterior mediastinum or follow the sheath of the subclavian vessels into the arm-pit. If the pus is in front of the prevertebral fascia and internal to the sheath of the vessels it acts in the same way as though it started in the pharyngomaxillary fossa. If the abscess is external to the sheath of the vessels and in front of the prevertebral fascia, such as would originate in suppurative adenitis of the deep glands, it tends to rupture externally and must be evacuated by an external incision. As has been stated, however, the fascia planes are not absolutely efficient barriers, and an abscess of the pharyngomaxillary fossa may communicate with suppurative processes external to the carotid sheath.

As has been shown by Mosher,[7] probably the greatest danger of deep abscesses of the neck is due to the effect of the suppurative process on the large vessels, producing sometimes phlebitis of the internal jugular or possibly its bulb, or, as in the case reported, causing erosion of one of the larger arteries occupying this important region.

The removal of tonsils under local anesthesia is a well-established and justifiable surgical procedure, but that it is absolutely free from danger, as has been claimed by some of its most enthusiastic supporters, is to my mind an unwarrantable conclusion. The real danger, as far as sepsis is concerned, is in the penetration of the injecting needle through the superior constrictor muscle. It is practically impossible to render and keep the mucosa of the tonsillar region aseptic in every case while making the injections, and this is especially so of the tonsil crypts. However if the injections are internal to the superior constrictor muscle the infection finds its most ready exit toward the throat, and unless very severe cannot be of a serious aspect. On the other hand, if the barrier of the superior constrictor has been passed

the large comparatively open space of the pharyngomaxillary fossa affords ample opportunity for an infection to develop and spread to a very formidable extent. I am inclined to side with my colleague of Philadelphia, who stated that he would rather give his patient a little pain than to risk the danger of a deep injection.

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# THE UNPLEASANT END-RESULTS IN WELL-PERFORMED TONSILLECTOMIES

CHARLES W. RICHARDSON, M.D.

The tendency of nature to replace tissues removed through accident or design to restore function through complementary or compensatory action, are well recognized facts to all surgeons. This action is observable in connection with lymphatic tissue, especially when removed in early life. Especially is this to be noted in connection with the faucial and pharyngeal lymphatic tissues. Almost every one of my hearers has seen these facts illustrated in some of their operative cases or in the operative work of some of their equally skilful colleagues. It has seldom been the lot of any operator, however skilful he may be in his operative dexterity, to find all of his cases one, two or three years thereafter to have absolutely clear tonsillar fossæ, free entirely of evidences of lymphatic tissue. Even though the operative field may be clear there is occasionally a case wherein there is an overgrowth of lymphatic tissue in close contiguity to the operative field. I do not wish to be placed in a position of stating that such occurrences are common after thorough removal of the faucial tonsils, for such is not the case. I wish also to discriminate between those cases in which the tonsils have been thoroughly removed and those which have been imperfectly removed, which latter can be readily differentiated from the types to which I refer. It is good practice to examine every case that has been operated upon, if the opportunity presents itself, after a period of months or years.

These few introductory remarks will bring us directly to the consideration of the unpleasant local end-results in well-performed tonsillectomies.

The first group will include those efforts of nature to replace lymphatic tissue removed from the tonsillar fossæ by hypertrophy of glandular tissue in the immediate neighborhood.

1. Hypertrophy of glandular tissue in the lateral pharyngeal wall posterior to the palatopharyngeal fold.

2. Hypertrophy of the lateral borders of the lingual tonsils.

3. Development or hypertrophy of glandular tissue in the palatopharyngeal fold.

In the first of the three groups above mentioned I do not refer to simple showing of moderate hypertrophy of the follicles usually found in this area, but refer to those distinct tumor-like growths of lymphatic tissue which in their size and conformity resemble miniature tonsils.

In 1910 I saw the first evidence of this type of nature's attempt to replace a removed tissue in close proximity to the destroyed gland. This occurrence took place in a child, aged ten years, upon whom I had several years before done apparently a perfect tonsillectomy. The case had been seen by a colleague, who promptly told the parents that I had not removed the left tonsil. They immediately called the attention of the fact to Dr. S. S. Adams, who referred the child back to me for reëxamination. On examination I was surprised to note in the left lateral wall immediately behind the posterior pillar a large mass of lymphatic tissue perfectly resembling a faucial tonsil.

In June, 1914, I had a young girl of fourteen come to me on account of an acute inflammation of the left ear. On examining her fauces I found a perfect pair of tonsillar fossæ, but immediately behind the posterior pillar a similar growth of lymphatic tissue, though not quite as prominent as in the case just narrated.

On March 1, 1922, I had a young boy of twelve years referred to me by a distinguished member of this association. In examining his fauces I found just behind the posterior pillar, in the lateral wall, a smaller but similar mass of hypertrophied lymphatic tissue.

The second group forms a most interesting series. I have seen six cases of this type, two in children and four in adults. The only one occurring following my own operative work was under my observation for aural treatment, twelve years after the removal of his tonsils. The patient stated that as it caused him no annoyance he preferred not having it removed. In depressing the tongue two dark-reddish raspberry-like masses were

observed filling in the lower part of the tonsillar fossæ, giving the casual observer the impression that the lower lobe of the tonsil had not been removed. Depression of the tongue downward and forward caused the masses to move with the tongue, showing the fossæ free, and demonstrated their true nature. The other three adults had discomfort and the masses were removed.

In the cases of the two children the condition was much more serious. The first case was that of a French child, a male, twelve years of age, who was brought to me to have his tonsils reoperated upon. From his parents I learned that he had had what was thought to be a perfectly successful tonsillectomy done in Paris when he was eight years old. During the past year all of his old tonsillar symptoms had recurred. For several months he had had suffocating attacks at night, which were gradually increasing in their severity. Each night he would be aroused several times through attacks of "night-terror." The child was anemic, under weight, and exceedingly nervous.

Examination of the fauces revealed large masses filling in the lower tonsillar fossæ. Depressing the tongue downward and forward caused these masses to follow the tongue and leave their position in the tonsillar fossæ. These masses were irregular, ragged, nodular formations of a deep red color. Further investigation demonstrated that the tonsillar fossæ were free of tonsillar tissue and that the presenting masses were outgrowths from the lateral borders of the lingual tonsils. This adventitious tissue was removed. The masses were $1\frac{1}{2}$ cm. in diameter.

The second case was that of a female child, seven years of age, whose tonsils had been removed when she was four years of age. She had been examined by several physicians in Pittsburg, all of whom believed that the tonsils had returned. The symptoms were similar but not as severe as in the case above narrated. The view obtained of the fauces and relation of the masses to the lingual tonsil were the same, excepting that the masses were not so large. They were removed.

*Deposition of Lymphatic Tissue in the Posterior Pillar.* I have seen three cases of large fusiform posterior pillars following perfectly performed tonsillectomies that had all the normal appear-

ances of tonsillar tissue. Two of the cases I saw on account of acute follicular infection that had the characteristic appearance and all the symptoms that constitute acute follicular tonsillitis. In fact in one, my own case, during the attack, I had to carefully examine the fauces before I could convince myself that the tonsillar fossa was clear.

In the healing process of enucleated tonsils, especially when the fossæ are very deep, there is a tendency to fill in the deep cavity by the development of granulation tissues. In most cases this granulating tissue is gradually absorbed in the natural process of repair, and we have a smooth, clean fossa. At other times this tissue undergoes organization with the appearance here and there throughout its structure of lymphatic nodes. All of us have seen these cases either in our own patients or in the patients of our colleagues. There can be no doubt that granulation or true tonsillar tissue can develop in the tonsillar fossæ some months, even years, after a thoroughly well-performed tonsillar operation. I have had under my observation on several occasions a woman for a recurrent subacute middle-ear inflammation. She had had her tonsils removed in Chicago some five years before I first saw her, and I remember when I first viewed her fauces how I congratulated her upon the perfect result she had secured. I saw her several times at more than yearly intervals and always inspected those perfect tonsillar fossæ. Last spring she reported to me again for a few treatments, and at this time told me she had been having for several months some soreness in the left side of her throat. Imagine my surprise at noting in the lower portion of the left tonsillar fossa a red inflamed mass nearly as large as the last phalanx of my little finger.

Allied to the above-mentioned group is the redevelopment of isolated areas of tonsillar tissue to large masses of lymphatic tissue in the tonsillar fossæ. These small areas develop at some period after the operation. It matters not how well the operation is done, all operators see these sequelæ. I see frequent evidence of this condition in very many cases of the best operators in the country. I have now a boy and a girl in their "teens" under my observation, who present this condition quite marked, who

were operated upon by a surgeon whom you and I recognize as the best operator in the United States. I had several years ago a case of this type that quite surprised me in several ways. The recurrence was no larger than a small pea, but displayed two follicles containing cheesy material. I had seen this child two years after a most perfect tonsillectomy and all was perfect in the faucial fossæ. I never did a more perfect operation. Four years after the original operation I was confronted with the patient and the rather indignant mother, who stated that the family physician had said that I had not removed the left tonsil. The child lost weight, her color was bad, no appetite, and she had grown listless, tiring quickly. I examined the fauces and saw the small pea-like excrescence of lymphatic tissue in the bottom of the fossæ. While carrying on a running conversation I cocainized the excrescence and quickly pinched it off before they realized my intention. Within a few weeks the child returned to the normal. I mention this case to demonstrate that we must not always consider these cases too lightly.

Adhesion or shortening of the anterior pillar by its adherence to the dorsum of the tongue and the adhesion of the lower lateral wall of the fossæ to the side of the tongue form another group. This group of accidents gives rise to very uncomfortable symptoms if we are to accept the statements of patients. Extreme care is the watchword to prevent this accident. Occasionally it will occur in spite of our best endeavors.

Injuries of branches of the hypoglossal nerve give rise to annoying symptoms. I have had one such case in my own practice and others in the practice of my colleagues.

My object in presenting this review of the unpleasant local end-results of well-performed tonsillectomies is to make us more careful in our work along these lines, so as to avoid as many of these pitfalls as possible; to make all endeavor to see our patients who have been operated upon six months or a year after the operation; to be more charitable to those with whom we work in a common field. Do not accuse any other man of having made an incomplete operation; no one can make such a statement with honesty unless he saw the operation performed.

## Discussion on the Papers of Drs. Wood and Richardson

Dr. John F. Barnhill, Indianapolis, Indiana:

I wish to report a case somewhat similar. A woman, aged thirty-two years, a professor in one of the Eastern colleges, came to my office, had the usual preparation, the usual tests such as are made before tonsillectomies, had a local anesthesia by novocain, almost a bloodless dissection operation, no subsequent disturbance whatever in so far as the local tonsillectomy was concerned, but two days later she had a severe chill, with high temperature, a septic condition, and died of multiple lung abscess later on.

Dr. Richardson reported what we all see, namely, that the best tonsillectomies do not always yield the best results, and it seems to me that those that seemed the most complete sometimes yielded the worst results, because there sometimes occurs subsequently in these very complete cases an accumulation of new lymphoid tissues behind the pillars. Anyone who dissects these new masses out will find they are much larger than they appear on the surface, since when they are dissected out there is a very deep fossa left. Dr. Richardson omitted to mention one class of cases in which there is no return whatever of any tonsillar or lymphoid tissue but in which the patient makes severe complaint of dryness or other annoying discomfort in the throat. Sometimes the complaint following an operation which, judging by every test, would be called a perfect tonsillectomy, is that taste is impaired or perverted. It is not easy to account for such complaints and all treatment seems useless. They wander from one specialist to another and some become pronounced neurotics. Injury to branches of the hypoglossal nerve are usually assigned as the most probable cause of the complaint.

Dr. Hanan W. Loeb, St. Louis, Mo.:

In the record of 332 cases hitherto unpublished of deaths from minor operations which I have succeeded in tracing there were several very interesting tonsil fatalities. The cases were a little different in type from those mentioned by Dr. Wood. They exhibited intense edema coming on very soon after operation, death resulting in a very short time. There were some cases of general infection also. This thing is of interest to me personally because my own particular group of men have in the past three or four years been having a great deal of joy in removing the tonsils under local anesthesia by Sluder's method. Before that time we hardly felt it was possible to do it.

Under improved methods of anesthesia we found that the Sluder operation was really beautiful, and we so far have had no bad results. In reference to the paper of Dr. Richardson, I think that also is timely. I too have seen the cases of which he makes mention most, namely, of increase in the lymphoid tissue just posterior to the anterior pillar of the palate so large they had to be snared off. Some go down in a year or two. Then there are recurring acute inflammations which attack the wall of the pharynx. I cannot tell how many cases of this type of acute lateral pharyngitis I have seen. I am not willing yet to go with Dr. Richardson on the theory that tonsil tissue recurs after complete tonsillectomy. I have removed tonsils perfectly as I thought at operation, and three days later I found I had not removed the tonsil completely. I do not know whether anyone else has had such an experience. I have seen rheumatism develop from a single crypt that was left when I thought I had removed the entire tonsil. My own feeling is, unless some capsule is remaining, there will be no recurrence of tonsillar tissue, but I know if I leave the minutest portion of capsule there may be trouble. I think this society should be very grateful that this feature of tonsil work should have been brought before us at this time.

Dr. Lewis A. Coffin, New York City:

These papers are timely and of interest. As to local *versus* general anesthesia I have favored local anesthesia in adults who have or can be gotten into the proper mental attitude. I want them to understand that in electing to have a tonsillectomy done under local anesthesia that they are expressing a willingness to spend a rather painful and disagreeable half-hour. There are adults who, owing to their mental instability or sensibility, if you will, should never be subjected to a tonsillectomy under local anesthesia, nor should children who have not arrived at an understanding and thoroughly comprehending age. I have heard more doctors talk of doing painless tonsillectomies than I have heard patients talk of having had painless operations done. Perhaps if we do not try to make it so painless it will be less dangerous.

In regard to Dr Richardson's paper: We have all had the experience of having a tonsil fossa that we had thought completely cleared of all tonsillar tissue presented at a subsequent time looking as though no tonsillar tissue had ever been removed therefrom. This condition of things arises apparently on account of a bunch of lymphoid tissue from the tongue falling or being pushed into the cleared-out fossa, where it seems to take root and grow.

I recall the case of a young lady who, on account of neuralgia and

rheumatism, was sent to me for the removal of tonsils. My operative results were apparently all that could be desired and the neuralgia and rheumatism both disappeared. However, about one year subsequently she returned and on inspection I found the left tonsillar fossa filled with what looked like a perfectly good tonsil. The interesting thing is that she had begun to suffer from her old trouble—neuralgia—which was entirely relieved after the removal of the new growth.

What Dr. Richardson calls "well-done tonsillectomies" I do not know. I do not suppose he means what Dr. Loeb means when he speaks of "perfect tonsillectomies," because he recommends that we be more careful; so if his well-done operations had been done more carefully he would not have had a paper at all.

An important point in Dr. Richardson's paper is that in all these cases, especially if not our own at original operation, we should be perfectly frank and honest, telling the patient or friends that such recurrences do occur after well-done operations, and that the operating surgeon should not be blamed.

Dr. John M. Ingersoll, Cleveland:

Dr. Wood's interesting paper brings out a point I should like to emphasize. In spite of every care these infections do occur. Many men doing tonsillectomies know that they are operating in an infected field, and for that reason they are less careful of their technic than in doing mastoid operations. Extreme care in the technic of tonsil operations may eliminate some of these local infections and at least gives one the feeling that the infection happened in spite of every precaution.

In regard to Dr. Richardson's paper, we all see these cases. Emphasizing what Dr. Coffin said, I think that we should all be very charitable in our judgment of these conditions. I should like to ask Dr. Richardson if he has any theory to offer whereby we may avoid some of these unfortunate after-results?

Dr. Elmer L. Kenyon, Chicago, Ill.:

I am wondering what a professional singer might think if he heard this discussion. The singer is in the position such as a surgical operator might be if he felt that through an operation his operating hand would be destroyed; and remember that the singer is not merely afraid of large things but of little things. He is afraid that the delicate things he can do will be disturbed. Now I am wondering what a singer would say if he heard the discussion here today in respect to tonsils removed.

The singer who has chronic tonsillitis, or is subject to acute tonsillitis, is more in need of a tonsillectomy than other people, because these very things tend to impair the finer possibilities of the voice. The function of the palatoglossus muscle is similar to that of the abductors of the vocal cords. That is to say, when one phonates an oral sound the soft palate is moved up to the posterior wall of the throat and the palatoglossus serves to quickly pull it down. Good singing requires excellent control of the palate. One of the results not uncommon, indeed seriously common, of excellently performed tonsillectomies is destruction of the action of the palatoglossus muscle. The palatopharyngeus muscle is attached to the larynx. It has to do with a perfect approximation of the vocal cords. At the same time it has to do with the control of the soft palate. The palatopharyngeus muscle is not usually disturbed seriously in well-performed tonsillectomies. But in any well-performed tonsillectomy hemorrhage may occur. Hemorrhage may lead to the necessity of working upon the very muscles that are so precious to the singer. The result may be muscle injury or infection, resulting in adhesion, with more or less serious impairment of delicacy in these parts for the purpose of singing, and this necessarily may occur in any well-performed tonsillectomy.

Now we all know that the thing we have to overcome with the singer if we do him good by performing tonsillectomy is the overcoming of his state of mind. It is that conquering of his psychology that has got to come before we can treat him as laryngologists as he ought to be treated. He is in a state of fear for his voice. Somehow or other we have got to get at the singer in a different way than we go at the ordinary individual in these tonsillectomies.

I want to put forward the idea of performing on the singer an intracapsular lymphoidectomy. If you leave the capsule in you do not have to get in contact with the muscles so precious to him. I have performed this operation quite a number of times. The difficulties of a nice accomplishment are serious and sometimes render the operation impracticable under the technic now employed. But when done successfully and delicately the musculature of the fauces is more likely to be left undisturbed for the delicate work of singing. Here, I think, is a practical suggestion for improving the service of the laryngologist to the singer.

Dr. Perry G. Goldsmith, Toronto, Ontario, Canada.

I address my remarks solely to Dr. Richardson's paper. I am sure I admire his courage in presenting a clinical paper here today which deals with his own difficulties. We are criticized very often by the

general profession and public because we do not remove from the side of the throat every bit of lymphoid tissue that is there. If we would educate the public and general practitioner to the fact that we are removing only one group of lymphoid tissue; and that it is impossible to remove all the lymphoid tissue on that side of the throat; and that it is quite possible that having removed this mass there may develop in that area a small nodule which in time may grow to look like a tonsil, but which is not; and that it may take part in attacks of inflammation as did the former tonsil; that it has no clinical importance as a tonsil removed; nor does it demand the same kind of clinical attention. Just as soon as we educate the public and general profession to this point, just as soon will this distressing criticism be obviated from our practice.

Dr. Greenfield Sluder, St. Louis, Mo.:

I will take probably two minutes to call attention to the observation of the recurrence in the tonsillar fossæ of lymphoid tissue. I have followed this for a number of years. It seems to me that lymphoid tissue after removal of a tonsil takes on, frequently, a compensatory action. It is not an uncommon thing to find lateral bands much larger than in acute infection, exactly as original tonsil appearance, and I have seen it repeatedly in young children, especially after a perfect tonsillectomy. Let me define perfect tonsillectomy—that is, not the appearance of fossa after removal but examination of the specimen where the capsule is absolutely intact. It should be not merely a surgically satisfactory specimen but an anatomically perfect one. In young children, as results frequently from the encroachment from the side, lymphoid will crowd in from behind. There is a small percentage where recurrence in the tonsillar fossa will make what appears to be absolutely original tonsil growing up from the tonsil lingual junction. It has occurred to me that there is a fibrous demarcation between the lingual and faucial tonsil. Dr. A. W. Proetz has made one section I know that did not find this demarcation. The lingual tonsil may project itself upward and behave as the original tonsil. One case I have particularly in mind was a perfect tonsillectomy in the year 1908. For ten years that boy, who was twelve years old at the time, the result stood absolutely perfect. On one occasion I looked again at this perfect result, and to my amazement, in the absolute center of the fossa, 2 cm. in diameter—not lateral encroachment—the center of the fossa presented a lymphoid follicle probably three-sixteenths of an inch in diameter. Now after ten years of such perfect standing result to find a lymphoid follicle develop in the scar base of the fossa

is a matter worthy of record and appeals again to the charity Dr. Richardson recommends in the criticism of our confrère's results.

Dr. Wood, (closing):

I have little to add as far as my paper is concerned, but would like to say a word about the recurrence of tonsillar tissue after a tonsillectomy. I have seen cases absolutely similar to those described by Dr. Sluder, namely, that the scar of a tonsillectomy may remain perfectly smooth for several months and later on lymphatic nodules develop on the surface. I do not believe, however, that these nodules are of clinical significance. A more potent source of infection is to be found in those cases in which pockets develop in the lower portion of the wound. These pockets are frequently due to the leaving behind of the lower portion of the plica. The edge of the plica becomes attached in the healing process to the posterior portion of the lower part of the wound, and there may develop behind this bit of plica a pocket which at times contains considerable purulent material. In fact, there may develop what looks like a retention cyst at this place, but the condition is easily relieved by the opening up of the pocket with the electric cautery.

Dr. Richardson (closing):

I want to say that about six years ago I met Dr. Matthews, late of the Rochester Clinic, and I asked him about his local tonsillectomies. He told me that up to that time he had had six most serious infections of the neck following local application. He used novocain. Dr. Barnhill, in his very brilliant discussion, spoke of those cases that almost or do become neurasthenics on account of the operation. We all see these. Excessive dryness of the pharynx is one of the complaints that annoys these patients most. I discussed that in my paper. It was impossible for me to go into all the details of various cases because I thought it would make my paper too long and too tiresome. I wanted to give the thought and let you have some imagination as to the rest. Dr. Sluder answered very well Dr. Loeb's inquiry. I cannot say that this tissue which reappears in the bottom of the fossa and along the anterior and posterior pillars is tonsillar tissue, but I know it is lymphatic tissue. I know because I have had it examined microscopically. No doubt a large part of this recurrence of tissue is, as Dr. Sluder has said, due to the lymphatic tissue creeping up from the lateral border of the lingual tonsil, or it may be due to the leaving of a little islet of capsule from which develops lymphatic tissue. Dr. Sluder seems always to get ahead of me. I was asked to define a

perfect tonsillar operation, but Dr. Sluder has already given my definition, that is, a tonsil removed with the capsule. The only time any man can say a man has failed to remove a tonsil is when he picks that tonsil up after removal and inspects it. If the whole tonsil is there with capsule attached, that is a perfect tonsillectomy, and any man who says your or my tonsillectomy is imperfect and has not inspected that capsule is dishonest. On the other hand, we all do what we call fairly perfect tonsillectomies. We may leave a little portion of the lower lobe of the tonsil behind. That is quite possible, we all do that—I should say most of us do it—occasionally.

The case I narrated in my other paper of the Chicago case, in which there was recurrences of tonsillar tissue after many years, during which time the patient was under observation, demonstrates this fact.

Dr. Ingersoll has asked me to present methods to prevent these recurrences. I cannot state better than that we must continuously exert ourselves to do the best that is in us. Some of these recurrences it is impossible not to have occasionally. Why in one case we should have a beautiful result, and in another tissue growth, both being done alike, it is impossible to state.

If we remove a tonsil as thoroughly as our dexterity will permit we fill the bill. I never was an exponent of those who believe in destroying all the lymphatic tissue in the neighborhood. The more we remove the greater the danger of producing that excessive dryness of the fauces and pharynx. Whether it is due to excessive removal of glandular tissue or to injury of branches of the hypoglossa is a question; but whatever the cause you leave the patient with a pharynx and fauces that may distress him for the remainder of his life. One thing we can always do, and that is show a charitable disposition to our colleagues. Do not condemn your colleagues not only when you know they do not deserve it, but also when they may possibly deserve a little criticism.

# THE TREATMENT AND PROGNOSIS OF CARCINOMA OF THE LARYNX

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THE secretary of the American Laryngological Association, Dr. Coates, has honored me with an invitation to speak before this illustrious assembly. I have decided to speak on "The Treatment and Prognosis of Carcinoma of the Larynx," a subject which I have specially studied for the last twenty years.

As you know, the history of the treatment of this particular disease is a long one and the literature on this subject is so extensive that I have to forego entering into it. We know, however, from Sendziak's laborious literary studies that already twenty-five years ago four periods could be established with regard to the views on the treatment of laryngeal cancers—that of therapeutic nihilism, the birth of a rational therapy, and the period of wavering views having been passed through in succession, while at that time one could speak of a period of sober criticism. Since that time the therapy of laryngeal cancers has been further advanced, on the one hand, by a better diagnosis of their earliest forms, and, on the other, by valuable and almost perfect modifications of the surgical methods, so that we might be justified in considering our present time that of achievement in the treatment of this malignant disease. Thus, Felix Semon (London) was able to say, in a lecture which was held not many years before his death, before the Japanese Medical Congress, that carcinoma of the larynx if diagnosticated in its early stages was curable in 80 per cent of the cases by laryngofissure and the excision of the soft parts, a method which your countryman Dr. J. Solis-Cohen has applied with very good results. Also, Gluck (Berlin) is said to have obtained excellent results, even in rather advanced cases, by his experimentally tried and later in over 300 cases practically applied modification of Billroth's total extirpation, so that in a

lecture held at Vienna in 1913 he was able to state that in a series of 86 operations he had only one case ending fatally, while in another series of 75 not a single patient died. The results of these two renowned surgeons seem to leave nothing to add to the surgical therapy of laryngeal carcinoma by giving our experiences and studies. But other writers report less favorably. Especially the Italian authors, Gradenigo, Egidi and others, would prefer total extirpation of the larynx instead of the thyreotomy recommended so warmly by Semon and Chiari. As to the total extirpation of the larynx the results of different surgeons have been various. Many, though following closely Gluck's method, have obtained less favorable results, which was already confirmed by the reports of N. H. Pierce, W. Freudenthal and others here in America. Moreover, it seems to me that general surgeons who take an interest in cases of laryngeal carcinoma, but being less acquainted with the smaller special laryngeal operations, as, for instance, with the endolaryngeal, even in early cases are too much inclined to resort at once to the great total operation. On the other hand, laryngologists often delay the total extirpation, notwithstanding proper indications for it. For these reasons I do not deem it superfluous to take up this question once more, though Otto Chiari, thirteen years ago, at the annual general meeting of the American Laryngological, Rhinological and Otological Society in Atlantic City, spoke on the same subject in detail. During more than twenty years of academical and practical activity I have employed various methods in operating on 141 cases of laryngeal carcinoma, and the results obtained and the facts observed have led me to views differing somewhat from those of the above-mentioned authors.

First of all, I will speak on the surgical methods which I used and the results obtained, following with a comparative criticism of other methods taken from the literature on the subject and ending with some general conclusions on the subject of laryngeal carcinoma.

The methods employed by me were five in number, namely, (1) endolaryngeal excision, (2) thyreotomy and excision of soft parts, (3) partial extirpation, (4) semilateral extirpation, and (5) total extirpation of the larynx.

1. The Endolaryngeal Operation. This method was first employed by B. Fränkel, with good results, on laryngeal cancer, but on account of uncertain results was rejected by most surgeons. Felix Semon was of opinion that early forms of laryngeal cancer, which according to Fränkel may be treated by an endolaryngeal operation, could be better and more safely treated with laryngofissure, and also Gradenigo, Otto Chiari, Chevalier Jackson, etc., severely rejected this endolaryngeal method for the surgical treatment of cancer. Gardenigo was even of opinion that the cases of successful operation had not been cancerous at all and that the time of postobservation had been too short. Being a pupil of Fränkel, I am still of opinion that the earlier a beginning laryngeal cancer is diagnosticated and the more certain the diagnosis is as regards the purely local form of the affection the more certain this small operation may be successful. This will not only preserve the physiological functions of the organ and avoid a deformed outward appearance but will also add to the fame of the surgeon as to his surgical dexterity. And if a properly diagnosticated very small carcinoma happens to be quite local, especially on the free edge of the vocal ligament, the endolaryngeal operation can be resorted to with good prospects. I performed it twenty-three years ago for the first time on a patient from Kumamoto, fifty-six years of age, who on the free edge of the right cord had a rugged polypous cancroid, the size of the tip of the little finger, which had not yet affected the ventricular membrane. The diagnosis was verified by microscopical examination of a test-piece, and I accordingly performed the endolaryngeal operation in two sittings within two weeks with such good result that the patient could be discharged from the hospital after two months. One and a half years later I presented this man at the Medical Congress in Tokyo, together with the microscopical slides made before the operation. At this time the right cord showed granular regeneration and produced a good voice. Since that time I have performed the same operation on 15 patients in whom careful examination only showed strictly localized polypous forms of cordal cancer, not yet spreading to the ventriculum, and also on two cases with pedunculer ulcerous forms of larynx carcinoma on the free edge of the epiglottis. The former

were mostly performed under the laryngoscope with the aid of the sharp larynx tongs or double curette; in only three cases "Schwebelaryngoscopie" was applied. The pendiculate forms were operated under the laryngoscope with the galvanocaustic loop, as shown by Loeb in his work on surgery, and the cancers at the end of the epiglottis also with the aid of the laryngoscope and the double curette. The results were, on the whole, very good: In five cases repeated examinations showed a complete cure, namely, the first patient who died eighteen years later at the age of seventy-five, of influenza pneumonia, was during all these years well and showed no signs of recidivation: the second case with dextralateral cord epithelioma remained well for eleven years; the third with sinistralateral cordal cancroid for eight years; the fourth with carcinoma pendula on the left ary-epiglottic fold, and the fifth with right cordal epithelioma were five years later quite healthy and free of recidivation. The other eleven endolaryngeal operations showed a relative cure, the patients left the hospital almost well, the scar was healed and no local relapse or glandular metastasis visible. Half of them, which could be kept under observation, were well after more than a year. They were all exhibited at the monthly meetings of the Japanese Otolaryngological Society. Only in 3 cases the results were not good: 1 case with medullary carcinoma of the left ligament, which besides the local symptoms of a sharply outlined superficial and rugged polypous growth on the middle of the left ligament already showed a slight affection in motility of the left ligamentum, had to be treated a second time endolaryngeally already a month later on account of recidivation, and two weeks later total extirpation of the larynx became necessary. The other 2 cases, one of carcinoma pendula on the tuberculum epiglottica and another of the right cordal cancroid, soon showed local recidivation, but further treatment was refused.

With the above results of my endolaryngeal operations I have been well satisfied, but unfortunately in the majority of cases of laryngeal carcinoma the operation cannot be resorted to because when the patients come to us it is already too late. I must emphasize that the indication for this minor operation must strictly be that the tumor is sharply defined in a small place.

In every case of such nature I am not satisfied with only the ordinary laryngoscopical examination but try to examine the ventricular space by my laryngoscopia ventricularis in order to see if the ventricular arch is already affected or not, and examine besides any possible affection of motility of the vocal ligament with the aid of the mirror. These two points I consider of the utmost importance to ensure the possibility of a successful endolaryngeal operation. The affection of the membrana ventricularis is a sign that the carcinoma is no more limited to the edge of the ligamentum, and a diminished motility of the cord, which according to Felix Semon is a very early symptom of laryngeal cancer, is in my opinion proof that the cancerous infiltration is no more superficial but has already penetrated into the cordal muscles or to the cricoarytenoidal joint. About the technic of the operation nothing new need be added. I would only recommend that after the tumor has been removed by any of the aforesaid methods the spot should be thoroughly cauterized with the galvanocaustic burner. Local radium application after the operation, which has lately often been applied for prophylactic purposes, seems to have been beneficial.

2. Thyreotomy. This method is said to have been first used by J. Solis-Cohen in 1868 for laryngeal carcinoma, but has come into vogue only later on the recommendations of Felix Semon, Otto Chiari, Hansberg, Chevalier Jackson, etc., against early forms of laryngeal cancer. Felix Semon, indeed, prefers this thyreotomy with the excision of the soft parts to the endolaryngeal operation recommended by Fränkel under similar indications as being not dangerous and prognostically much better and for the preservation of the voice much more favorable. He was also of opinion that the estimation of the extent of the infiltration could not always be properly ascertained by laryngoscopy, and the excision of the tumor by the endolaryngeal operation is not always sufficient. But I still maintain that a smaller operation should, if possible, be resorted to if it can be presumed that all diseased parts can properly be removed; thus I have had little opportunity to use thyreotomy, because I have employed the former method where other authors resorted to thyreotomy. Only when the cordal carcinoma had, notwithstanding its early

stage, already penetrated into the ventricular membrane or to the ligamentum thyreoarytenoideum or motility disturbances already appeared have I made this operation—12 cases in all: 4 of these were cancroids of the right or left vocal ligamentum, 3 adenocarcinoma of the ventricle, 2 cancroid of the vocal cord and ligamentum thyreoarytenoideum, and 1 case each of medullary cancer of the left cord and adenocarcinoma of the left ligamentum thyreoarytenoideum. The results of our operations were not so good as those reported by Semon and Chiari: 5 cases showed local recidivation, 2 of which were afterward treated with total extirpation, and the remaining 3 were lost sight of; 2 cases ended fatally, one by infectious pneumonia and the other on account of general debility after a long treatment for granulative proliferation on the wound; only 2 cases proved entirely cured (one for over five years, adenocarcinoma of the left ventricle, another for over two years, cancroid of the right chord), the remaining 3 cases left our hospital in good state but could not be kept under observation. The reason that my cases of thyreotomy gave inferior results is probably that they were much more unfavorable from the beginning, for the lighter cases were all treated endolaryngeally where others would have applied thyreotomy. Under these circumstances I consider my results fair enough, considering that there already had been extensive infiltration and yet 2 definitely and 3 relatively cured cases could be shown. The technic of the operation does not call for any remarks here, except that thyreotomy was always easily performed with cocain or novocain infiltration, sometimes combined with subcutaneous injection of pantopon-scopolamin solution, and that the bleeding in operating the cordal carcinoma was never severe, so that I never was obliged to ligate the arteries or to apply Trendelenburg's or the sponge cannula. I always performed tracheotomy shortly before the operation proper and the wound of this was always provided with the ordinary tracheal cannula, which was removed after one week. The laryngeal cavity after the splitting of the thyroid cartilage was immediately painted with cocain-adrenalin solution, and after the operation tamponed for a day with iodoform gauze. The further treatment was without tamponade.

3. Partial Resection and (4) Semilateral Extirpation of the Larynx. Both methods were formerly frequently resorted to in the treatment of laryngeal cancer, seldom with good results. I have therefore always been of opinion that sharply defined semilateral or localized cancers, as such of the epiglottis, which had penetrated rather far, but which appeared as if easily removable by semilaryngeal or partial resection of the larynx, should, from the point of prognosis, at once be totally extirpated, because in both procedures the prophylactic precautions against pneumonia are insufficient and the inclination to recidivate is very marked. For these reasons I have found few occasions to make practical use of any of these methods. But induced by Gluck's report, which he made in 1913 at the meeting of German naturalists and physicians in Vienna, that of 49 cases of hemilaryngectomy he had only 3 deaths but 21 complete cures, I used this method in 2 well-defined cases of semilateral cancer, but unfortunately lost both, one by pneumonia after one week, the other through recidivation after five months. Partial extirpation I performed three times, twice for carcinoma epiglottis by using pharyngotomia subhyoidea. Of these, one, the last, was successful, in which I, after removing the epiglottis tumor, sewed the wound surfaces of the basis of the tongue and the aryepiglottical folds together to prevent pneumonia. After three months, by a small reoperation, communication between the pharynx and the larynx was again established and the outer subhyoidal opening closed. The other 2 cases, where, after exact extirpation of the epiglottis tumor, I closed the outer wound with sutures, ended fatally through penumonia. These experiences confirmed me in my opinion of the unpracticability of hemilaryngectomy and partial extirpation of the larynx.

5. Total Extirpation of the Larynx. Notwithstanding the good results of thyreotomy and laryngofissura obtained by such renowned specialists as Felix Semon, O. Chiari, Chevalier Jackson and others, and of the endolaryngeal operation by Fränkel and myself, they can only be used in a limited number of cases, as cancer of the larynx usually comes before the specialist in already relatively advanced stages. Therefore the principal operation will always remain the total extirpation of the larynx,

as only in this way can all pathological processes in the larynx be radically removed, and by further improvement of this method the inoperable cases may in future be more and more lessened in number. After Billroth first tried it, in 1873, many famous surgeons followed him, but, as you know, the results of these operations were at first not at all good, though, as Sendziak's statistics show, the fatal cases have become fewer in the course of time and some complete cures were even established in this method (Obalinsky, Solis-Cohen, etc.). Thus, on the one hand, a pessimistic view came into vogue which, supported by statistics, repeatedly asserted that humanity would lose nothing by giving up this method, which was not to the credit of surgery; on the other hand, it is undoubtedly true that in recent times the total extirpation of the larynx carcinoma is quite frequently practised by surgeons and by many laryngologists and that the results have become increasingly better. This progress has no doubt gone hand in hand with that of aseptic surgery in general, but for the progress in this special line we are chiefly indebted to Gluck, of Berlin. In 1881, at the Surgical Congress in Berlin, Gluck published his experimental treatise, in which he showed that in extirpating the larynx, or more generally expressed in all operations, which so often cause death by pneumonia through the entering of foreign bodies into the air passages, an absolute guarantee against this form of pneumonia could be established by prophylactic resection of the trachea and circular sewing up of the central stump of the trachea into the epidermis. In the years following he practised this method with excellent results on many patients, and thus Gluck's method of total extirpation of the larynx has been brought to its present standard of excellence. The principal procedures of it are: (1) Complete exposure of the larynx before opening the air passage; (2) severing the larynx from the pharynx; (3) immediate closing of the pharynx defect while the larynx is drawn far out of the wound; (4) severing the larynx from the trachea; (5) circular sewing-in of the lower stump of the trachea into the skin wound, and (6) closing of the whole wound by sutures.

Nineteen years ago I tried this method for the first time, but an unexpected difficulty made me modify Gluck's method to

some extent, which, however, also gave satisfactory results. The patient was a merchant, fifty-one years of age, who suffered from interior carcinoma of the larynx. The left-sided infiltration had already extended over the commissura anterior to about one-third of the right larynx. The symptoms were severe hoarseness and a moderate feeling of stenosis in the larynx. I intended

Fig. 1.—Okada's method, No. 1.

to follow strictly Gluck's procedure, but during the chloroform narcosis symptoms of suffocation suddenly set in which induced me to alter the operation somewhat, inasmuch that after the T-shaped epidermis cut in front of the larynx and the trachea I immediately amputated the latter below the ring cartilage by a cut slanting upward from front to back, after severing the

thyroidal cartilage from its surroundings, applying a ligature at its isthmus in two places, cutting through and freeing the trachea where the resection was to take place with two raspatories from both sides and from the esophagus. Then followed Gluck's sewing-in of the lower tracheal end into the epidermis in order to reëstablish the breathing under narcosis with less danger and

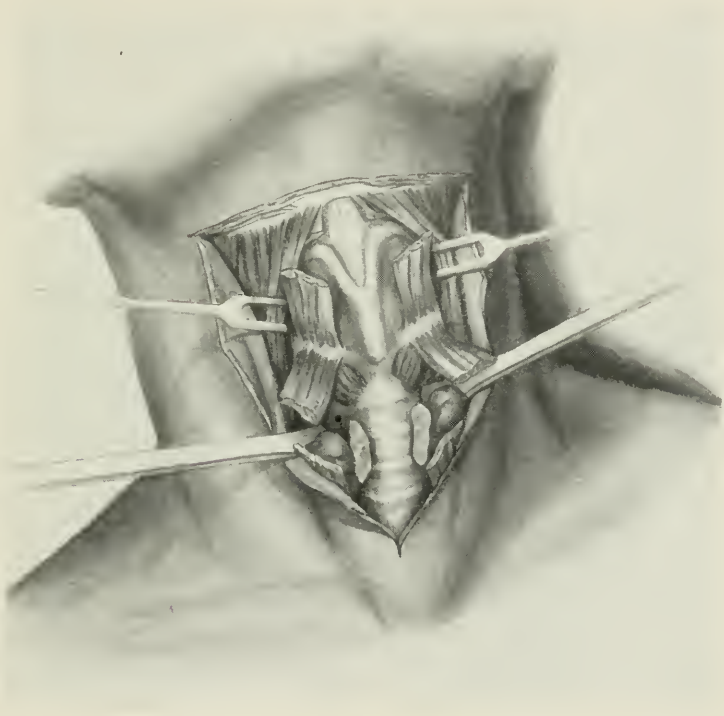


Fig. 2.—Okada's method, No. 2.

to completely prevent blood or mucus entering the trachea. Then the larynx was freed from the esophagus from below upward. Starting from a point near the upper rim of the cricoid cartilage the anterior hypopharyngeal wall was freed by dissection, partly blunt and partly sharp, whereby the cornu superius of the cartilage was reached and cut off on both sides with scissors.

Until then the pharynx had not yet been opened. After the whole wound, especially the part of the hypopharynx and the esophagus and all exposed muscles, had been covered with thick gauze strips the pharynx was opened subhyoidally and immediately tamponed with gauze to prevent flow of secretions and infection of the wound surface. Then followed the severing

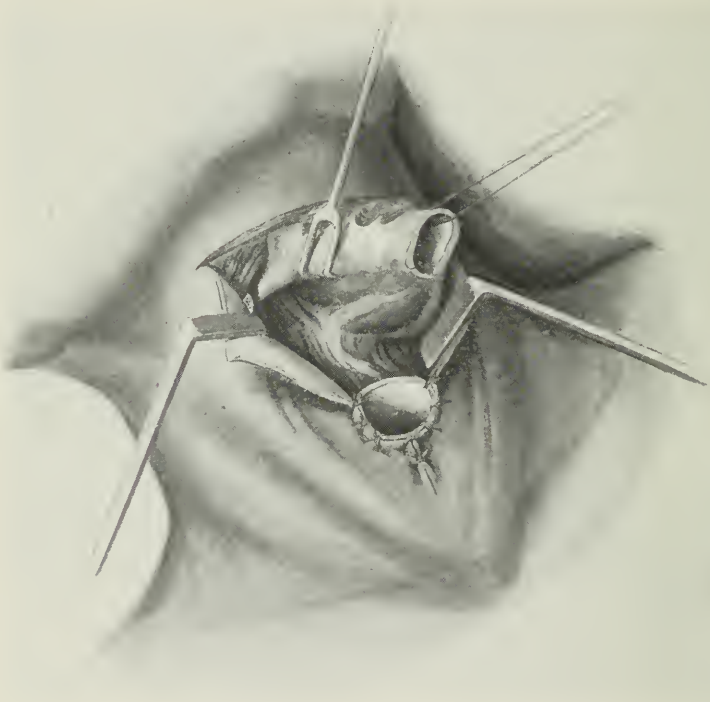


Fig. 3.—Okada's method, No. 3.

of the larynx from the pharynx and the sewing-up between the root of the tongue and the upper stump of the front wall of the esophagus or hypopharynx. Finally, after making counter-openings on both sides of the tracheal opening, the outer subcutaneous wound was thoroughly tamponed with iodoform gauze and the epidermis ends were sewed together. For one week only

liquid food was given by means of a permanent esophagus catheter. The convalescence was excellent, all sutures healed per primam intentionem; after ten days food could be taken without the catheter and after two months the patient could be discharged cured. He was subsequently demonstrated at the monthly meeting of the Japanese Otorhinolaryngological Society together

Fig. 4.—Okada's method, No. 4.

with the removed parts. The man is still living, and with his seventy years quite well and active. It should be added that he can speak in whispers and make himself understood in the beginning with the aid of Gluck's rubber tube but later without it. Encouraged by this success I have up to December of last year (3 cases in this year cannot be counted-in yet) performed the

same operation in 106 cases of various forms of laryngeal carcinoma both interior and exterior forms, with and without accompanying glandular metastasis on the neck, with the following results: 36 cases showing no recidivation after three years and 55 cases relatively cured, including all successful cases within the last three years, and those who were discharged cured but

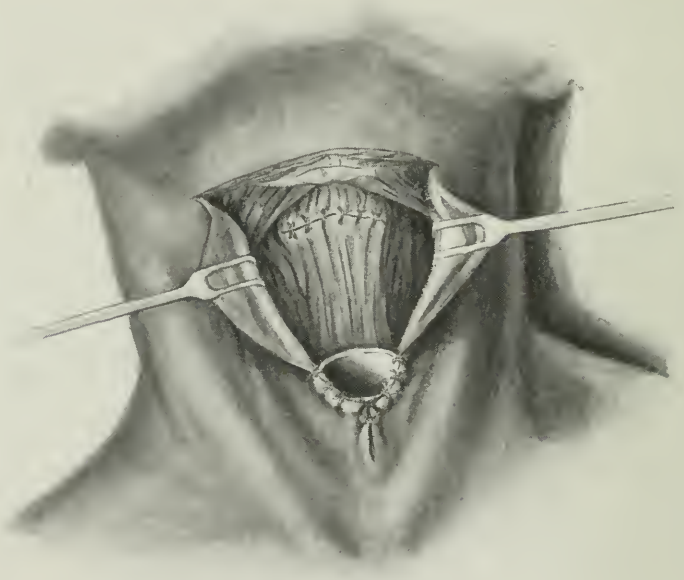


FIG. 5.—Okada's method, No. 5.

have been lost sight of; 10 cases recidivated, 2 of them locally near the epiglottis, 1 at the thyreoidea, which latter was completely cured after reoperation; in 7 cases glandular recidivation appeared, some of which could be relatively cured by reoperation.

Six cases ended fatally within one to four weeks after the operation: 1 on the tenth day through erysipelas, another on

the seventh day through uremic anuria; 1 case ended on the twenty-fifth day on account of general debility and 3 with infectious pneumonia. The infection was, however, not caused by the influx of blood into the trachea, but later (2 cases within ten days, 1 after two weeks) on account of local suppuration of the wound.

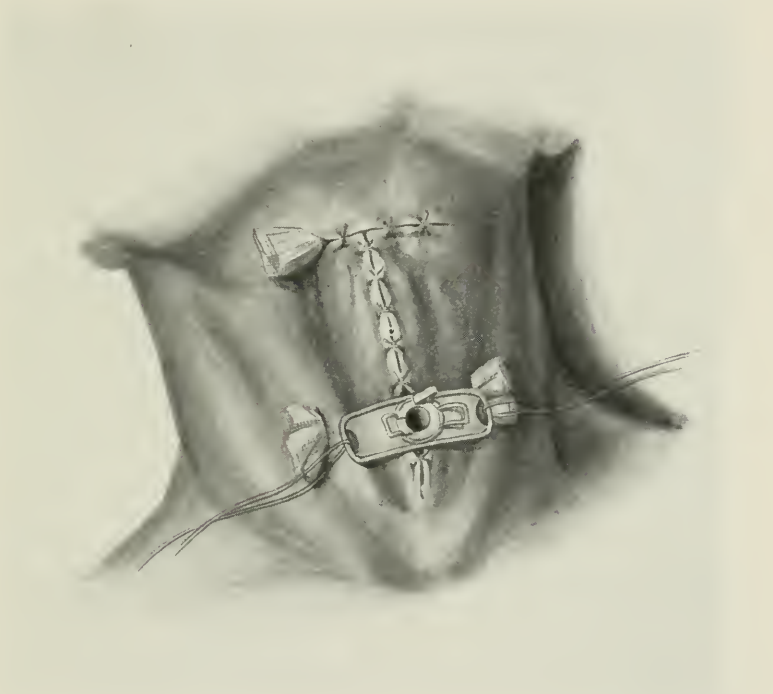


Fig. 6.—Okada's method, No. 6.

Compared with Gluck's my results do not appear so good, but I must mention that I have ventured to operate on cases which, according to Cerny and others, were until now considered inoperable—on aged persons of seventy years and more, on patients who already showed glandular swellings on one or both sides of the neck, in the hope of reducing the number of inoper-

able cases as much as possible. Taking all this into consideration I think I can be satisfied with my results. Moreover the causes of death in these 6 cases were not the effects of the operation itself but mostly some accidental neglect, which with greater watchfulness on the part of assistants and nurses may be avoided. I therefore feel myself justified in recommending the above method to you, adding the following critical remarks:

The *modus operandi* adopted by me is really not new. From remarks made by Gluck I know that a French specialist, Lubec, long before Gluck, performed a very similar operation by resecting as a first act the trachea and sewing its lower end into the skin, letting the principal operation follow a fortnight later. Here in America James Bell is said to have reported in 1909 on 8 successful cases, which he had operated on in a manner very similar to mine, saying, "Without previous tracheotomy the larynx is removed from below upward after sewing the trachea to the skin." It is really not my intention to raise here the question of priority. I only wish to state that as early as 1903 I used this method on a patient on whom I intended to perform Gluck's total extirpation, when some difficulty accidentally arose on account of the patient, and that since then I have practised this modus for nineteen years in more than 100 cases of laryngeal carcinoma, finding that it is easier to perform and less risky and that it provides the same protection against infectious pneumonia as Gluck's method. If it should be objected by Gluck that in the procedure of laryngectomy the total extirpation of the larynx from below upward increases the risk of infection on account of the early opening of the trachea, I would say, on the contrary, that the earlier opening of the pharynx cavity, which is the essential part of his procedure, is a source of danger from wound infection. For even if the mouth and pharynx cavity are at once tamponed with long strips of gauze and the wound surface likewise packed with gauze, very often quantities of mouth or pharnyx secretions exude from the cut with reflectory retching or swallowing movements. This not only greatly hinders smooth working but can frequently give opportunity for infection. In this respect I think my way to be even better, because the opening of the pharynx cavity comes last, after the trachea and the

larynx have been completely separated from their surroundings and all wound surfaces have been thoroughly tamponed, and for a very short time only the pharynx cut remains open, for immediately after tamponing the mouth and pharynx cavity with gauze or sponges follows the sewing up between the base of the tongue and the upper rim of the anterior border of the hypopharynx, and, if necessary, the wall of the esophagus. Moreover the early resection of the trachea and the sewing of its lower stump to the epidermis I consider to be not at all so dangerous as Gluck believed, because the breathing opening is thus far removed from the chief field of operation. The following points I carefully heeded during the operation:

1. The operation must be made under the strictest aseptic and general surgical rules.

2. It may often be performed with the local application of anesthetics, as nearly all Austrian, French, Italian and other specialists have expressly recommended. I myself have used successfully in 6 cases novocain infiltration combined with previous injection of pantopon-scopolamin. But considering that with such a long and complicated operation a general chloroform narcosis is much more convenient, because the patient very often still feels pain after simple anesthetization, and that the injection of pantopon-scopolamin is not always harmless, as P. Heyman has asserted, I have mostly used general chloroform narcosis and never perceived any bad effects.

3. Though Gluck for initial skin incisions formerly recommended the formation of a large winged flap in front of the larynx, and later a median longitudinal cut from the height of the hyoid bone to the jugulum and two horizontal incisions, one at the height of the hyoid bone, the other at the lower edge of the cricoid cartilage, from the anterior edge of one sternocleidomastoideus to the other, as being best for opening up the field of operation in all its parts and to make possible a reliable drainage of the wound cavity after the operation, I prefer the T-shaped cut between the hyoid bone and the fossa jugularis, by which I could sufficiently fulfil Gluck's two conditions, and which in some respects seems to me even of greater advantage, inasmuch as the tracheal stump sewn-in need not be freed unnecessarily from its surroundings but can remain in firm connection with it.

4. In resecting the larynx any tearing or injury to the surrounding muscles, fasciæ, vesicular sheaths, etc., must be avoided as much as possible.

5. The thyreoidea, if still quite healthy, is better left in by ligating it in the middle of the isthmus in two places and cutting through between. If, however, the carcinoma has already penetrated into the neighborhood of the gland and there is any suspicion of its being affected it may likewise be removed. I have not been able to confirm that the removal of this gland is in any way harmful to the organism.

6. As Gluck has already fully explained, I too advise the removal of the regional lymphatic glands and ducts. Only in cases of well-localized carcinoma intrinquus without glandular swellings I leave these parts alone. But in cases in which the lymphatic glands already show swelling, or with carcinoma extrinquus, I carefully try to remove all existing glands, even the smallest, together with all lymphatic vessels lying between the diseased part and the muscles and fasciæ. Cases in which the metastatic glands are already of considerable size and adhering to the large vessels of the neck must be declared inoperable.

7. I will not enter into details about the after-treatment, but make only some few remarks:

(*a*) The gauze strips left in the wound cavity are removed after one week if nothing untoward has occurred until then and replaced by small drainage tubes.

(*b*) For feeding I frequently introduce the small permanent catheter through the nose, or in some cases two or three times a day the usual esophagus catheter orally into the stomach. But I prefer the former, as there is danger of piercing the pharyngeal sutures with the latter.

(*c*) If the healing process progresses well the permanent catheter is removed after one week and the patient can be fed in the ordinary way. If the pharyngeal sutures have opened, however, the catheter must be left in longer.

(*d*) If the strength and the state of the patient permit it, it is advisable to make him get up as soon as possible and even let him walk about the room.

General Remarks and Conclusions. From all the facts presented here we can clearly see that we are in the period of achievement as regards the treatment of laryngeal cancer and that Virchow's words have been realized, "If cancer is in its beginning and for some time longer a local affection it must be possible to cure it locally at this stage."

And there is no doubt that the sooner the beginning carcinoma of the larynx is diagnosticated and treated by a suitable operation the more likely the success of the operation, as Fränkel and others have repeatedly said. We also know that the prognosis of laryngeal cancer has, with the progress of laryngeal diagnosis and with the development of suitable operating methods, going hand in hand with the general progress of surgery, become greatly improved, as recent statistics show. But if we compare the number of cases which have been treated successfully, either by operation or otherwise, with those not operable or operated unsuccessfully, it becomes clear that we must not rest satisfied with what we have achieved. In our university clinics, in which, roughly, 8000 patients annually are taken in, and in my private hospital I have seen within these last twenty years over 400 cases of laryngeal cancer, of which the majority, for various reasons, could not be operated on, partly on account of extensive glandular metastases, partly because of severe cachexia or general debility, or on account of coexistence of other diseases—affections of the kidneys, heart, lungs etc., and often also because of the refusal of an operation by the patient or his relatives. Our aim must be to improve the prognosis. To this end I wish to express our desiderata in the following concluding sentences:

1. We must instruct the general public and practising physicians, by writing and by speech, that laryngeal cancer may begin without a known cause and without severe symptoms, sometimes with simple hoarseness or with slight stinging pains in the throat, symptoms which may probably be diagnosticated by the ordinary physician as nothing more than laryngitis simplex, and that just this beginning form, prognostically and therapeutically, is most important, for it is certain that this form can with great probability be cured by a comparatively simple and harmless operation, endolaryngeal or by thyreotomy.

2. Practising physicians and family and companies' doctors often have opportunities of observing these beginning forms and should become at least as familiar with laryngoscopic as with stethoscopic examinations. To attain this end I would propose to improve the methods of teaching laryngoscopy and to raise the position of laryngology in the realm of medical science.

3. We specialists should in all suspicious cases endeavor to make an exact clinical diagnosis as early as possible, combined with microscopical examination of a test piece which has been immediately cut out after the laryngoscopical examination. If exact diagnosis shows the case to be one of cancer a suitable method of operation must be selected according to the exactly ascertained nature of the case.

4. We must not mechanically stick to only one method of operation but must be able to individualize and prefer the smaller operation to the larger; but in case the indications should point to the necessity of the larger operation we must not hesitate in employing the same.

5. For selecting a suitable method I would propose my modus, which has proved practicable by long experience: Sharply defined polypous forms on the free edge of the vocal cord which have not yet penetrated into the ventricular membrane or the movable forms of the carcinoma pendula are best operated on by the endolaryngeal excision of the tumor—of course, by a well-practised hand, with indirect method or with the so-called "Schwebelaryngoskopie." In case these localized forms of the laryngeal cancer have already penetrated deeper into the ventricle, or in cases of primary ventricular forms (mostly adenocarcinoma), or if the surgeon is in doubt as to his dexterity for an endolaryngeal operation, I should recommend thyreotomy with subperichondral excision of the tumor afterward.

In cases in which the carcinoma has not only affected the vocal cords but also the arycartilage or the cricoarytenoidal joint or the posterior wall of the larynx, or has progressed over the anterior commissure to the other side, total extirpation must immediately be resorted to if the constitution of the patient permits.

Partial resection of the larynx and hemilaryngectomy are,

according to my experience, not very practicable; they may even prove dangerous, as it is difficult to separate the wound cavity from the air passage by a tissue wall. I would recommend this method only for sharply defined epiglottis carcinoma, as we can ensure security against infectious pneumonia by a temporary closure of the introitus larynx by the sewing-up of the base of the tongue with the upper rim of the posterior wall of the larynx. Hemilaryngectomy would be better replaced by total extirpation.

This brings my short exposition to a close. Gentlemen, I thank you for the patience with which you have listened to my inadequate remarks on the subject.

# CANCER OF THE LARYNX: IS IT PRECEDED BY A RECOGNIZABLE PRECANCEROUS CONDITION?

CHEVALIER JACKSON, M.D.

This paper deals with the larynx only, and that but briefly. Its length would be increased to ponderous proportions if it were expanded to include even mere mention of the important corroborative examples of precancerous conditions in other regions of the body, even if the author had the ability and the time. The reader is referred to the masterful article by my colleague, Dr. W. M. L. Coplin.[1]

Fully recognizing the etymological and scientific faultiness of the word "precancerous," nevertheless it seems necessary to use it even if we must concede it a place little better than the algebraic "$x$." Disclaiming any attempt to maintain a brief for the word itself, the author's clinical experience with cancer of the larynx leads him to the conclusion that cancer rarely if ever appears in the previously perfectly normal larynx. The chief objection to the term "precancerous" is that it will be loosely applied without a true anatomic basis, hence it is unscientific; but if it supplies the need for a word that will contribute to the education of the profession and the laity to the undoubted clinical fact that there is a class of morbid conditions in the larynx the cure of which will diminish the incidence of cancer, the use of the word is justified until someone suggests some other single word that shall serve the same life-saving purpose.

For all clinical purposes the term "precancerous" may be defined as any histologically abnormal condition intervening between the normal and the cancerous. It will not be disputed that such a condition exists, though there is room for widely differing views as to its frequency, because of the difficulties of its determination in any given case.

Fundamental to the acceptance of the view that there is a precancerous condition is the acceptance of the view that repeated injury and long-continued irritation and inflammation are potent causes of cancer. Present limits preclude consideration here of the evidence on this subject. Anyone who is unwilling to accept this view is referred to the overwhelming evidence presented and ably analyzed by Coplin.[1]

Vocal Abuse as a Cause of Cancer. It is my belief that prolonged vocal abuse can be a factor in localizing cancer in the larynx. It seems certain that this factor has been overlooked and does not show in statistics because, as a rule, vocal abuse itself is in most cases overlooked. In most statistics only professional singers and speakers and street-hawkers are recognized as abusers of their larynges; whereas, as a matter of fact, they constitute but a small proportion of the persons who suffer from chronic laryngitis, papillomata, granulomata and keratoses as the result, wholly or partially, of vocal abuse. All statistics of cancer entirely overlook the vocational abusers who are compelled to force the voice in noisy and dusty places, the colloquial abusers, etc. Another factor preventing the statistical showing of a preponderance of professional voice-users among cases of laryngeal cancer is that the irritation caused by professional use is very much lessened by proper methods of vocalization. Still another factor is that persistent vocal abuse results in such a degree of impairment of the voice that the speaker or singer retires and the irritation ceases. Out of 582 cases of proven cancer of the larynx in my experience there had been undoubted vocal abuse in 376 (64.6 per cent). Of the remaining 206 many should be classed as having abused their larynx, but these cases were not included because of incomplete records or some other factor that prevented absolute certainty. Of the 376 approximately one-half—187 (49.8 per cent)—were professional or vocational voice users. These included not only speakers, teachers, singers, hucksters street-hawkers, sales-persons, foremen, drill-masters, etc., but mechanics and factory employees required to talk loudly in noisy, dusty places and persons employed in many other vocations ordinarily little suspected of requiring excessive use of the voice. The balance, 189 (50.2 per cent),

used their voices for continuous conversation. They were of what might be called a colloquial temperament. By this term is meant the numerous class of people who talk practically all the time they are awake. If no listener is available they will hunt one; if none can be found they will talk or sing to themselves. Continuous phonation with them is a nerve cell habit whose cycle is the outlet for every efferent impulse excited by their daily contact with the world. Often my secretary, attendant, nurse and assistants have noticed that these people, though under my strictest orders not to talk, would, while waiting to consult me, needlessly talk all the time in the waiting room. Many of such persons are to be found among the vocational voice users who add this abuse to the vocational abuse. One form of vocal abuse not often recognized is talking, even though not loudly, in a dusty place. When talking every person is for the time a mouth-breather. Mouth-breathing is one of the well-recognized causes of chronic laryngitis.

That vocal abuse causes cancer is too broad an assertion. But that it is one of the commonest causes of chronic laryngitis, keratoses, papillomata and granulomata is proven by experience; and that these conditions when perpetuated by vocal abuse and other causes can be a suitable soil for the development of cancer is, in my opinion, abundantly supported by clinical observation. The etiologic effect of vocal abuse is shown by the therapeutic effect of absolute silence. In the author's experience there is no other means to compare with absolute silence in remedial efficiency in all forms of laryngeal disease. By absolute silence is meant the writing of everything that the patient has to say, even whispering being forbidden. Laryngeal lesions of the most widely varying character, such as lues, tuberculosis, benign growths, even cancer itself, will show local improvement under a strict silence régime. That the improvement in cancer is a lessening of cellular lawlessness cannot be maintained, but that the associated congestive, inflammatory and irritative phenomena are decreased to the extent of a lessening of the stenosis has been clinically observed in the author's cases so frequently as to admit of no doubt. The author has often seen papillomata, granulomata, small edematous growths and other benign inflammatory

tumors totally disappear under silence treatment. It is my rule to enforce silence during the period in which I am studying a new case for diagnosis. Over and over again it has happened that the improvement and shrinkage in obviously benign growths has been so great that I have, in many cases, decided not to operate, and occasionally this decision has been rewarded ultimately by the total disappearance of the growths without other measures than absolute silence.

The bearing of all this on the present subject is that if we are prepared to admit that irritation is one known cause of cancer, and that vocal abuse is one cause of laryngeal irritation, the conclusion is obvious that vocal abuse deserves consideration as a precancerous condition.

Eversion of the Ventricle as a Precancerous Condition. In using this term the author feels a very justifiable doubt as to whether or not there actually is a prolapse of the mucosa of the laryngeal ventricle. In using the term he refers to those cases in which what looks like a fold of normal mucosa can be tucked back into the ventricle with a probe. In two of the author's cases of this kind he felt justified in considering the condition as precancerous. In one of these cases a man who had an eversion of the ventricle first discovered in him by Dr. John Sterret, ten years later came to me with a fungating cancer on the same side as the eversion, the cancerous lesion involving part of the everted fold and part of the corresponding ventricular band. Removal of an ample specimen, which was examined histologically by Dr. Ernest Willetts, proved the cancerous nature of the lesion.

Lues as a Precancerous Condition. In 12 of the author's cases of cancer of the larynx there was a luetic lesion preceding the cancerous lesion. Of these cases 3 were superficial, 2 fungating, 2 granulomatous, 5 ulcerative. Of the ulcerative lesions 2 were known to have started as gummatous lesions. In all of the cases the luetic lesion had been present many months, and in 4 of the cases had been made to disappear temporarily by the administration of mercury. Besides these cases in which laryngeal luetic lesions were cancerous, in many other cases there was a luetic lesion and such cases seem to me to be of a greater degree of malignancy. I am aware of the fact that the foregoing statistics

do not warrant it, nevertheless my opinion is that lues favors cancer of the larynx. A number of other laryngologists have made the same observation. Mr. Tilley[2] states, "I have noticed that a large proportion of my cases of epithelioma of the larynx have previously suffered from syphilis." My colleague, Dr. Coplin,[1] gives a most logical explanation of the connection between lues and cancer that seems to fit particularly well the clinical observations in my cases of postluetic cancer. He states: "My thought is that the infection bears an etiologic relation because it is manifested by a reaction of irritation and not because there is what, under other conditions, might be regarded as any specific connection between the tubercle bacillus, the treponema, blastomycetic fungus, various diphtheroids, cocci or other organism and the newgrowth. In a manner resembling but quite clearly different the microörganism in some way liberates one or more toxic substances which irritate, frustrate repair and lead to a lawless cellular proliferation similar to that following the continued irritation produced by soot, tar, pitch, paraffin or other substances possessing allied possibilities and the irritation accompanying certain animal parasites. In this connection it is interesting to note that no infective process exclusively or even largely suppurative tends to tumor formation. The cytologic reaction in purely suppurative lesions, such as abscesses, is not reparative, it is protective; repair follows, and only when repair is constantly frustrated does the tendency to neoplastic evolution become manifest."

Keratosis and Leukoplakia of the Larynx as Precancerous Conditions. Leukoplakia, so commonly precancerous about the mouth, I do not remember ever to have identified in the larynx, though I have seen conditions superficially resembling it. Keratosis, on the other hand, is relatively common, and almost every laryngologist has seen cases in which a condition with the gross appearances of a keratosis has ultimately proven malignant. It seems logical to suppose that some, at least, of these cases were similar at some stage to Case IV, reported below.

Tonsillar Disease as a Cause of Cancer of the Larynx. The tonsil has long been recognized as the fountain-head of a majority of the cases of disease of the throat. It has not here-

tofore been accused of causing cancer of the larynx. But we all know that a local infection in the tonsil can be the chief etiologic factor in chronic laryngitis, and if we admit, as I think we should, that chronic laryngitis can be a precancerous condition, we must admit that a diseased tonsil can be a cause of cancer. Tonsillar disease is certainly often overlooked in persons of cancerous age. In one of the author's cases he overlooked a chronic infective condition in the tonsil and the lingual lymphoid apron that was afterward discovered by Dr. T. R. French. In commenting upon the case, Dr. French made the following statement: "Since I have been occupied in investigations of diseased lymphoid tissues in the throat my attention has, a number of times, been attracted to the disappearance of small neoplasms and inflammatory thickenings after removal of material containing pathogenic bacteria. As a consequence I have long been impressed with the possibility of cancer being due to infection."

Benign Growths as Precancerous Conditions. Here we enter on a subject upon which whole books have been written on the laryngeal phases alone. Sir Felix Semon, many years ago, in his exhaustive *Collective Investigations*, showed conclusively that the repeated removal of a benign growth as a clinical fact had not been demonstrated to have caused cancer. This has never since been disproven. In Semon's day the removal of a specimen was done by the indirect or mirror method of laryngoscopy, the technical difficulties of which were so great that a greater proportion of small and unrepresentative specimens were removed than is the case by the direct methods of today. As Jonathan Wright has said of such specimens, they might be "not even from the growth itself" in some instances. But even today it is no uncommon thing for the first specimen removed to show a papillomatous, keratotic, ulcerative or granulomatous histology, to be followed later by a specimen from the same larynx showing undoubtedly cancerous processes. This does not necessarily mean, however, that the cancer has been a sequel of the other processes. Papillomata, granulomata and keratotic lesions are of inflammatory origin and may have coexisted with the cancer in a different part of the growth at the time the first specimen

was taken. Irritation and inflammation may have been the original cause of both without necessarily a sequence. Moreover, once the barrier of a normal epithelial surface is broken, mixed pyogenic infections result in inflammatory processes. The author has seen a number of instances in which a cancerous ulcerative lesion has developed in adjacent tissue villous projections that grossly and histologically resembled papillomata rather than exuberant granulations. In such cases cancer may be said to be "prepapillomatous." The etiology of benign growths is a closely related subject of which space forbids full consideration. From his experience in benign growths of the larynx the author is convinced that the chief factor in the production of laryngeal papillomata, granulomata and hematomata is some form of irritation including trauma and chronic inflammation. The limits of the present paper forbid the review of the data upon which th s opinion is based, but it may be mentioned that the author has seen 3 cases of papillomata occurring in soldiers who had been gassed and who had suffered continuously with a chronic laryngotracheobronchitis. Mr. Tilley[2] reported a case of this kind before I had seen any of the cases mentioned.

Bearing of Location of the Lesion on Precancerous Conditions. All statistics show a great preponderance of squamous-cell carcinoma in malignant disease of the larynx. While it is true that metaplasia to the squamous type may and probably does occasionally occur in cylindrical and glandular-cell carcinomata, yet this metaplasia is so rare and the clinical evidence is so conclusive that all must admit that one or the other vocal cord is the most frequent site of origin in cancer of the larynx. It is an indisputable fact that of all regions in the larynx the vocal cords are the parts subjected to the most irritation in practically every human being. It is also a well-known fact that benign growths appear most frequently at the site of greatest irritation, namely, in the central zone of the anteroposterior extent of the cord. Recent observations by Major Ryland[3] show that it is this central zone that suffers most in fatally gassed soldiers.

Contact Cancer of the Larynx. The author has seen 2 cases in which an isolated cancerous lesion developed on one cord

at a point precisely opposite an isolated cancerous lesion on the other cord, both lesions touching during phonation. In neither patient was there any continuity between the lesions. In both patients the twin foci were histologically cancerous; one case ended fatally, the other is still living after thyrochondrotomy. These isolated twin foci have been noted by other laryngologists,[4] and have been referred to as "contact infections." It would seem logical to class them etiologically rather as the result of mechanical irritation of the first growth on the vulnerable epithelium of the opposite cord.

Histologic Appearances of Precancerous Conditions. Here we encounter difficult, perhaps insurmountable, difficulties. Coplin[1] states in effect that in the production of cancer it may be assumed that the previously normal epithelial cell must have acquired not only the ability of proliferative invasion but the ability to transmit to new cells the same power of proliferative invasion, a power which the normal epithelial cell did not possess. If such power were present but latent, then we must assume that something occurred to rouse the power and that this power is transmitted in most instances from the original focus. It is this power that is the intangible thing that we all know is present, but as yet not materially demonstrable, that presents the greatest difficulty in the study of precancerous conditions. Coplin[1] states: "Every discerning student of cancer must have apprehended reaction to irritation and other cell changes preceding cancer must be potentially malignant before it is possible, by means at present available, to demonstrate histologically the impending malignancy; a cell or tissue must be preparing and finally must be prepared to infiltrate before the process is manifest. . . . Naturally a cell has made necessary preparations for doing a thing before it does it; histology rarely, if ever, tells us what a cell is going to do before it does it, although many of us are constantly deluding ourselves into the belief that we can deduce the future of a cell from a study of the past or present or both. . . . much less can one tell what a cell is going to do when neither it nor any ancestor has yet done the thing in the particular case under investigation; the fact that other cells, in other cases, similarly situated, have followed certain or uncertain

courses may be suggestive, even helpful, but offers nothing conclusively applicable to any other case." Jonathan Wright evidently had the same thought in mind when he stated, years ago, that it is too much to expect a prognosis to be based entirely upon histologic examination.

Reports of Cases. Space permits the insertion of only a few cases. I have selected four that illustrate in a marked degree certain phases that were present in greater or less degree in many others:

Case I.—A man, aged sixty-eight years, was referred by Dr. Jacob Wolf. The patient had been continuously under treatment for ten years for progressively increasing laryngeal disease before coming under the writer's observation. Hoarseness had been present to a greater or less extent for five years. Progressive infiltration, worse on the left side, reduced the lumen to a narrow chink. The left cord was fixed. The author did a total laryngectomy. Histologic examination by Dr. Jonathan Wright showed the growth to be an endothelioma. Recurrence ended fatally one year after operation. The case is elsewhere reported in full.[5] It is alluded to here because of the long duration (eleven years) of infiltrative laryngeal disease. It seems altogether improbable that the growth was endotheliomatous from the beginning. The assumption seems warranted by the statements obtained from the laryngologists who treated the patient that he had an infiltrative laryngitis as a premalignant disease.

Case II.—Male, aged fifty-five years, referred by Dr. John Dunn for consultation as to possible malignancy of the larynx. The patient complained of "soreness and stiffness" on talking and swallowing and impaired voice, in varying degrees, for two years. He had been treated by various laryngologists for chronic tonsillar disease, chronic pharyngitis and chronic hypertrophic laryngitis for a number of years prior to coming under Dr. Dunn's observation. Internists had been able to reduce a blood-pressure of 200 to 145, and they had been able to control a chronic nephritis and a cardiac lesion. On mirror examination the larynx was found infiltrated and thickened, evidently by a prolonged chronic laryngitis, the thickening in the posterior commissure being almost similar to that seen in pachydermia. The similarity was increased by small crusts visible below the glottis. The thickened hypertrophic mucosa rolled out of both ventricles on phonation in a way that would, I think, be regarded by

some laryngologists as an eversion of the ventricle. The roll obscuring the region of the right cord was granular and roughened. No definite form of a cord could be made out on either side and both sides overlapped on phonation, the sound of which was as rough and deep as if made with the ventricular bands, though these did not touch. Dr. Dunn, from mirror examination, regarded the laryngeal condition as probably cancerous. While the writer did not feel so strongly impressed in that direction it seemed to be a case in which a specimen might well be taken for diagnosis. This was, however, contraindicated by the fact that if the laryngeal condition were found histologically malignant operation would be inadvisable because of the patient's arteriosclerosis and his cardiac and renal conditions.

Three years later the patient was again sent by Dr. Dunn for consultation. The patient had pain in the larynx radiating to the ears, tenderness over the larynx and over palpable lymph nodes on both sides of the neck. Dyspnea was quite troublesome at night, but not so noticeable during the day except on exertion. Mirror examination showed the larynx narrowed by encroachment from both sides and the anterior wall. On the right side there was a bulging mass of fungations from an ulcerated base occupying the location of the cord and ventricle. The glottis was occluded in its anterior portion. The mobility of both arytenoids was impaired. The condition was clearly inoperable not only because of involvement of the party wall and extensive lymphatic leakage but because of the cardiac, vascular, and renal conditions. Evidently radium offered the only hope of palliation if the condition proved malignant, but it was also evident that enormous dosage would be required, and such dosage would not be justifiable unless certain of malignancy. It was therefore decided that I should take a specimen. The histological report of Dr. A. G. Ellis was "squamous-cell epithelioma."

Radium treatments were carried out by Dr. William S. Newcomet and had a decided effect in reducing the infiltration both in the larynx and in the neck. The lumen of the chink increased in area. The patient died of angina pectoris three and one-half years after Dr. Dunn first made the diagnosis of cancer from laryngoscopic appearances.

Comment. The progress of the case indicated the correctness of Dr. Dunn's mirror diagnosis of malignancy. The case was undoubtedly one of those slowly developing laryngeal cancers that run a protracted course, in this case over three years.

Thyrochondrotomic removal could not have been adequate; laryngectomy, if not fatal, could not have given more than the five and one-half years the patient survived. The phase of the case that bears on precancerous disease is the long duration of a laryngeal irritation and hypertrophic laryngitis from defective metabolism, vocal abuse, cigarette smoking, tonsillar disease, etc.

Case III.—Miss A. K., aged forty-nine years, referred by Dr. Preston M. Hickey and Dr. Herman H. Sanderson for diagnosis of suspected malignancy of the larynx. The patient gave a long and interesting history of laryngeal disease.

The voice during childhood had been harsh at times, so that people thought she had a "cold." At the age of twenty years the patient took up vocal training and the voice cleared, so that for six years she sang mezzosoprano in church. For one year the patient gave singing lessons. At the age of twenty-nine years the singing voice was lost and the speaking voice became increasingly hoarse. The patient then entered the Long Island Hospital for training as a nurse. At the age of thirty-one Dr. Thomas R. French saw her larynx. He has kindly furnished me the following notes: Hoarse for two or three years, which she attributes to strain in singing. Throat easily tired on use of the voice. No pain. Larynx appeared normal in color and movements, but a small, flat, very white growth (or crust) was noted below the anterior commissure. A beautiful water-color drawing of this growth was made by Dr. French. The growth was still present four months later. The left aryepiglottic fold was edematous and later congestion of the left vocal band was noted.

At the age of thirty-three years the patient became aphonic. She then came under the care of Dr. Herman Sanderson, who found a papillomatous condition with a thickening of the left ventricular band.

At the age of thirty-seven years, the patient being still aphonic, Dr. Chevalier Jackson, holding a clinic at the Harper Hospital in Detroit, removed a specimen from the larynx which was reported as insufficient for diagnosis. At the age of forty-five a degree of phonation was noted for a period of a year. At forty-six the patient lost her voice every time she "took cold," the cords being noted by Dr. Sanderson as thickened but not red. At forty-seven the voice was permanently lost and dyspnea became noticeable. Dr. A. B. Wickham (Detroit) gave a series of violet-ray treatments which greatly improved the dyspnea. Recently, however, the dyspnea had reappeared.

At the age of forty-nine years, almost thirteen years after I first saw the patient, she was again referred to me by Dr. Sanderson for the taking of a specimen and the relief of the increasing dyspnea, which had become exceedingly distressing and was threatening asphyxia at night. Except for dyspnea the general condition of the patient was good; she felt perfectly well and had lost only three pounds in weight. There was marked indrawing of the guttural fossa and around the clavicles. Otherwise the general examination was negative.

*Laryngoscopic Appearances.* Mirror examination showed nothing resembling cords. From the inner border of the arytenoids downward the larynx on each side was filled with a nodular mass of tissue that obliterated the glottic chink except for a small triangular space posteriorly. Attempted phonation showed good movement of the arytenoids, but the movement brought no cords into view. (See color plate.)

*Direct Laryngoscopy and Removal of Specimen.* The dyspnea having increased until tracheotomy was indicated a direct laryngoscopy was done. The larynx was found infiltrated (though not hard) from the border of the ventricular bands downward. An ample specimen was removed with basket punch forceps, the tissue being soft and cutting easily; time, one minute and forty-five seconds. A second specimen was taken after nine months, radium having been used in the meantime. Both reports follow:

*Histologic Report.* "First Examination: Specimen consists of a fragment of tissue measuring 0.75 cm. by 0.75 cm. by 0.5 cm.; weight less than 1 gm. One side is flat, apparently the base; the other aspect is rounded. A small spicule extends from one margin but does not appear to have a pedicle.

"Rapid technic.

"Histology: Sections show a diffuse infiltration of connective tissue and muscle by solid masses of squamous epithelium which has undergone no keratinization. In some areas marked leukocytic infiltration and hemorrhage can be seen. The mucosa is absent except at one margin of the surface.

"Diagnosis: Basal-cell epithelioma. B. L. Crawford."

"Second Examination: Specimen consists of a small, irregular, grayish piece of tissue measuring 0.75 cm. by 0.5 cm. by 0.25 cm. The tissue is friable.

"Formalin-alcohol fixation.

"Histology: The small piece of tissue possesses a membrane of stratified, squamous epithelium on one surface, which is inflamed and ulcerated; on the opposite surface is a small strip of cartilage. The submucous tissue is extensively infiltrated by masses of epithelium. The infiltrating epithelium at the site of the ulcerated area is continuous with the surface epithelium, and there are also isolated nodules beneath that portion of the mucosa which is intact. The infiltrating epithelium shows little evidence of differentiation, for the most part the cells being irregular in shape and size; however, in places the cells resemble those of the prickle layer and in small areas show slight indication of keratinization. There is also extensive leukocytic infiltration throughout the tissue.

"Diagnosis: Squamous-cell epithelioma. B. L. CRAWFORD."

*Tracheotomy* was done under local anesthesia. Recovery was prompt and uneventful.

*Radium Treatment.* The patient was then referred to Dr. D. Bryson Delavan and Dr. Thomas R. French for consultation. They decided to place the patient under the care of Dr. Douglas Quick for energetic treatment by radium. She is still under the treatment and is improved.

COMMENT. Here is a case in which there was laryngeal trouble and vocal abuse for thirty years or more. Neoplastic conditions were present for at least thirteen years before the diagnosis of cancer was made. Over twelve years elapsed between the specimen reported insufficient and the one reported positively for cancer. It is impossible to say when the pathologic process took on malignant qualities. No one can regard the condition as malignant for thirty years. We must therefore grant that at some stage not yet cancerous the epithelial cells were preparing to sally forth on the invasion that we recognize histologically and clinically as cancer. *That stage was precancerous.* This fact is not altered by our inability to detect its presence in a given case.

CASE IV.—A. R., male, aged forty-two years, had had hoarseness off and on for a number of years, the voice being normal or nearly so in the intervals. He had a chronic hypertrophic laryngitis for which he had been treated at various times for a number of years. About a year prior to consulting me, an able laryngologist had noted on the center of the right cord "a limited patch of white thickening similar

Precancerous keratosis in a man aged forty-two years (Case IV). The upper illustration shows the mirror view before operation. The lower illustration shows the view at laryngofissure.

to a keratosis." The patient failed to appear for reëxamination until eleven months later, when the same laryngologist noted that "practically the whole extent of the left cord was replaced by a snow-white, rough growth. The cord moved but appeared sluggish."

This was also the condition upon my first examination. (See color plate.) Prior to coming to me the patient had been seen by Sir St. Clair Thomson, Mr. Hunter Tod and Mr. Herbert Tilley. We were all of a similar opinion that while a benign condition, such as a keratosis, could not be excluded without histologic examination, yet the strong suspicion of malignancy warranted prompt action and especially so as the growth was extending toward the arytenoid region, where the chances of operative cure, if malignant, would be, to say the least, much lessened. It was therefore decided that Dr. Ellen J. Patterson and I should do a thyrochondrotomy, and, after splitting the thyroid cartilage, decide upon the question of how radical the removal should be. Dr. Patterson and I operated on January 3, 1916. The following is a copy of the report of operation:

"When the larynx was opened the growth did not look manifestly malignant to us. There was no detectable infiltration, no extension downward beyond what might be called the lower limits of the cord. The slightly nodular appearance mentioned by Mr. Tod, and which seemed to us quite marked at indirect laryngoscopy, was not so much in evidence at thyrotomy. On the other hand it did not resemble any benign growth. The experience we all have had with growths of the clinical characteristics of this one led me to decide, in consultation with Dr. Patterson, to remove the entire growth with a wide base of normal. The growth, however, was so manifestly superficial that we did not deem perichondrial dissection with complete left-sided evisceration necessary.

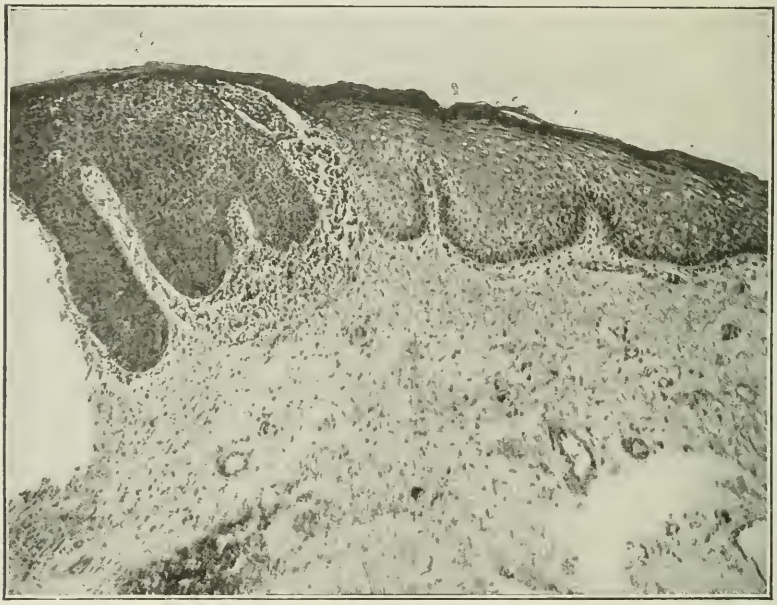
"Dr. Ernest W. Willetts immediately examined the frozen section and his preliminary report on a frozen section was 'precancerous.'"

"*Microscopic Examination.* The only pathologic change noted in sections is confined to the epithelium. This shows very marked thickening, with a tendency to form down-growths into the underlying tissue. Immediately beneath the epithelium there is quite a thick layer of lymphocytes and plasma cells which are seen particularly immediately underneath that part of the epithelium which shows the thickening.

"For the most part the epithelial tissue is sharply defined from the underlying tissue, but at several points this is not so sharply marked. Some of the cells are atypical as to size and staining. At several points there appears to be beginning hornification within the center

of the epithelial plugs like the very first beginning of the epithelial pearls such as are seen in epidermoid carcinoma.

"Diagnosis: Precancerous condition or possibly just beginning epidermoid carcinoma."



PHOTOMICROGRAPH OF TISSUE FROM LARYNX OF PATIENT, CASE 4.

FIG. 1.—Extreme edge of pathologic process and approach to nearly normal contiguous mucosa. To observer's right slight reaction, some thickening of epithelial strata, and little increase in keratinized layer. Passing from left to right, just to left of middle of section, almost sudden change becomes obvious. Very notable overgrowth of epithelium, which stains more deeply, often intensely, with loss of regularity and uniformity of cell arrangement and grouping; basal cells extremely polymorphous, of all sizes and without sharp, clearly cut, uniform border. Keratinization of outer stratum very marked near transition point and extending over more active area to left as well as over less changed tissue to right. At point of transition very intense mononuclear collections, especially conspicuous between epithelium and old submucosa, into both of which structures, however, mononuclear invasion occurs. Other sections showed more clearly and more conspicuously the changes mentioned, but were prepared by freezing, were not so well stained, and could not be photographed satisfactorily. (Photomicrograph from laboratory of James Ewing; tissue sectioned and stained by Ernest W. Willetts; legend dictated by W. M. L. Coplin).

Dr. Willetts sent slides to Dr. James Ewing, who reported as follows:

"Your laryngeal specimen is very interesting and rare. I have no doubt that you are justified in believing that this is one of the ways intrinsic cancer of the larynx begins. It may not be the only one. The sudden transformation from the normal to the hyperplastic and atypical epithelial pegs is very striking and at once sets the progress apart from inflammatory changes.

"I do not think the condition can at present be called cancer. It has not any of the essential features, not even sufficient atypical qualities of the cells. I have seen other beginning laryngeal cancers in which there was less overgrowth and more marked changes in the cells. I suppose the next step would be breaking away of the cells and invasion of the submucosa, but I should not expect this until the cells change their appearance considerably. This is the stage in which to treat cancer of the larynx, not after it gets well advanced."

No sutures were used either in the cartilage or in the soft parts. The system of after-care originally devised by Dr. Patterson was skilfully carried out by her. The recovery was uneventful. The patient returned to England three months later and I have not seen him since; but a letter from Mr. Hunter Tod, eight months after operation, reported the larynx in good condition, with improving motility and favorable progress toward the development of an adventitious cord. The voice had returned, and though still hoarse has lost the forced huskiness. I have heard through Dr. Herbert E. Smyth that the patient is alive and well. I hope before this paper goes to press to have a report from Mr. Hunter Tod as to the present condition of the patient's larynx.

Comment. This case illustrates clearly and conclusively the value in laryngeal surgery of acting upon a clinical diagnosis of a precancerous condition. This case is a leading one in that the opinions of three eminent pathologists were to the effect that while the condition was not cancerous, and, furthermore, while they could not undertake to make any prognosis as to what the cells were going to do, yet they all seemed to regard the case as one in which they would not be surprised to see malignancy develop. In other words, they seemed to feel that the cells might be prepared or preparing to do something not already done, though the present limitations of histopathology would not warrant the positive statement of such an opinion.

This state of mind would seem parallel to that of the laryngologists concerned in the case. I believe every laryngologist of large experience can recall cases in which he regrets that he had not followed his undefined and undefinable feelings as to present or incipent malignancy in cases reported as histologically benign; and while it can, of course, in most instances be maintained on good grounds that there was malignancy in some unexamined portion, yet the clinical fact remains that had the laryngologist followed the guidance of an intuition born of clinical experience the patient's life would have been saved. Just what constitutes the appearances in a laryngeal lesion that give rise to a subconscious feeling of incipient cancer is difficult if not impossible to describe. In the same patient different laryngologists have given me quite different phases of the lesion and its history as the bases of their opinions, notwithstanding the fact that their opinions coincide as to the suspicions of malignancy. Notwithstanding the fact that it would be manifestly out of the question for any pathologist to say on the basis of an examination of a removed dead cell what the adjacent living unremoved cells were going to do, I feel that the histologic appearances here go far to corroborate the clinical view that there is a curable precancerous morbid state that precedes malignancy in many cases of cancer.

Treatment of Precancerous Conditions. As Coplin[1] has so well said: "The practical application of our recognition of irritation as a frequent antecedent of malignant disease becomes obvious. It is not necessary to assume that there is a specific tumor excitant, cytologic, microörganismal, or chemical, but that cancer often arises under influences the nature of which we cannot at present accurately define, but which tentatively may be termed irritative, fully recognizing how vague and unsatisfactory the designation must be. Fortunately, for practical purposes this particular indefiniteness is no impediment to our understanding the application to prevention and treatment. Every delay in healing of any nonsuppurative process in which the normal tendency to repair is unduly prolonged, no matter where—skin, mucosa, lip, eyelid, tongue, stomach, intestine, rectum, bladder, mamma, vulva, uterus, prepuce or elsewhere—every irritated gland, wart, or mole becomes a source of suspicion."

My experience in clinical laryngology leads me to believe that this clear and concise statement applies with special force to the larynx.

If the author's views are accepted, the cure of chronic laryngitis becomes of fundamental importance. Unfortunately we are confronted at the outset by two obstacles in dealing with persistent, intractable, chronic laryngitis:

1. The difficulty of obtaining absolute rest for the larynx, especially in the case due in part or wholly to occupational vocal abuse, dusty occupations, cough of extralaryngeal origin and the like. Even the normal respiration of the dry, overheated, dusty atmosphere of the average dwelling in the United States is injurious to the individual larynx peculiarly susceptible to such irritations.

2. Laryngectomy leaves the patient in such a deplorably crippled condition that we cannot consider for a moment the total removal of an otherwise incurable, chronically inflamed larynx only suspected of being potentially cancerous, as has been so wisely urged by Bloodgood[5] in parallel cases of chronic mastitis. Nevertheless the study of the case will usually find which causes, among the many, of a chronic laryngitis are operative, and having found them a cure will follow. Tonsillar infective diseases are well-known factors in the production of chronic laryngitis. The writer was particularly struck with the discovery by Dr. T. R. French of a chronic tonsillar disease of long standing in the case reported below as Case IV, and his comments thereon are important.

Keratoses and similar overgrowths of epithelium occurring in adults are to be dealt with as potentially precancerous. The opinion of Dr. James Ewing, commenting on the histology of a specimen in one of the author's cases, namely, that "this is the stage in which to treat cancer, not after it gets well advanced," in my opinion expresses such a great clinical truth in such a great way that it encourages me in making a plea before this Association for the clinical recognition of a precancerous condition. And while I realize that we cannot now definitely lay down specifications and descriptions of precise characteristics by which a precancerous condition can be identified in a given case, I think it will be a step toward the ultimate attainment of such an ideal

if we begin by recognizing the fact that there exists a group of cases not already cancerous in which the malignant possibilities are so great as to justify wide removal of normal tissue surrounding the base of the lesion. The general surgical rule, applying to individuals past middle life, that benign growths exposed to irritation should be removed, probably applies to the larynx as well as to any other epithelialized structure. In regard to papillomata, however, radical surgery and radium burns from excessive dosage are to be avoided as disastrous to the voice and the lumen of the airway, as well as quite unnecessary for cure. Superficial removal and avoidance of all irritation, such as tobacco-laden or dusty atmosphere, vocal abuse, the cure of tonsillar infections (see Dr. French's comment in Case III) will effect a cure with excellent vocal results. The author's case records show numerous instances in which papillomata, granulomata, and edematous polypi of the larynx have shrunken and in many instances disappeared by the sole influence of absolute silence.

Conclusions. 1. While there is here offered some evidence bearing on the histology of precancerous conditions this evidence is not conclusive.

2. Clinical work is not and never can be ideally perfect. We are human and our patients are human. We cannot expect in our clinical work on the living human being to attain even to the relative certainty of the postmortem room.

3. As laryngologists we are concerned with saving human lives from the inroads of a "dire disease," which is the appellation applied to cancer of the larynx by Sir Henry Butlin.

4. If we admit, as I think we should, that certain curable laryngeal conditions are in some cases the sequential predecessors of frequently incurable cancer, it is clearly our duty not only to eradicate those curable precancerous conditions but to contribute to their early recognition by applying to them the term "precancerous," however faulty such a word may be from a purely scientific, histologic point of view.

5. From a clinical point of view we may regard continual laryngeal irritation from any cause—chronic laryngitis, keratosis, syphilis, pachydermia, so-called prolapse of the ventricle, and benign growths—occurring in a person of cancerous age as clini-

cally precancerous in the sense that they may be contributory factors in the etiology of cancer, and as such should be cured, surgically or otherwise, as may be indicated.

6. It is no argument against this life-saving rule to contend that these conditions are too rarely predecessors of cancer to justify regarding them as etiologic factors in cancer. There is no known agent causative of any disease that will always, in all individuals, under average conditions of exposure, produce that disease. The human race would be extinct if such were the case.

7. The time has come for the laryngologist to follow the lead of the general surgeon and the gynecologist in the recognition of the necessity of curing cancer before it starts.

8. There will be fewer deaths from laryngeal cancer when every member of the medical profession fully realizes the frequently malign nature of chronic hoarseness.

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# REPORT OF A CASE OF CARCINOMA OF THE LARYNX: LARYNGOFISSURE

HERBERT S. BIRKETT, M.D.

A. M. S., male, aged fifty-eight years; occupation, train despatcher. This patient was kindly referred to me on September 23, 1919, by Dr. V. A. Hart, of Barrie, Ontario, on account of hoarseness which had resisted the usual remedies for supposed cold in the throat.

The patient stated that the voice had been husky off and on for one year before I saw him and that the hoarseness had been permanent for the past four months.

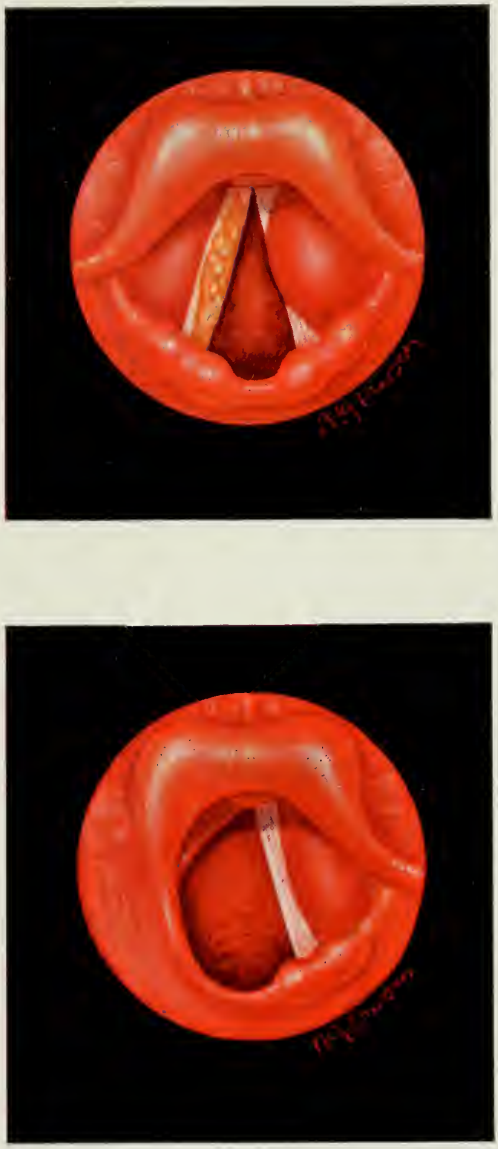
Examination of the larynx revealed an ulceration of the right vocal cord on its superior surface, extending from the anterior commissure backward to about 2 mm. from its insertion to the vocal process. In outline it was somewhat oval, the inner edge of which extended downward, involving the subglottic area for 3 mm. The surface of the ulceration was covered in its entirety with a whitish, yellow-looking slough. The left false cord, which was swollen but not infiltrated, hid the whole third of the true vocal cord from view. The color of the mucous membrane of the larynx was slightly darker than normal. The movements of the right vocal cord were not as active as those of the left.

*Personal History.* No previous illness and no history of lues.

*Physical Examination.* Absence of any disease of the thoracic or the abdominal viscera. The roots of several teeth were found very defective and the gums surrounding them unhealthy. All the defective teeth were removed and the mouth was brought into a more healthy condition pending operative interference on the larynx.

October 3 the patient was admitted to the Royal Victoria Hospital. The following day, under local anesthesia, the larynx was examined by the direct method, whereby it was possible to obtain a better view of the full extent of the ulceration of the right vocal cord anteriorly than by the indirect method. The ulceration was found to extend 1 mm. beyond the middle line.

A portion of the growth was removed for microscopic examination, with the distinct understanding with the patient that should it prove



Dr. Birkett's case of laryngofissure. The upper illustration shows the condition before operation.

to be malignant operative interference would be consented to. The pathological report proved it to be a squamous-cell carcinoma.

November 2 the operation of laryngo-fissure was undertaken under chloroform anesthesia, the patient having had a hypodermic injection of $\frac{1}{8}$ gr. morphin and $\frac{1}{150}$ gr. atropin three-quarters of an hour before the operation.

A low tracheotomy was done without previous local infiltration anesthesia. A very broad isthmus of the thyroid gland was found occupying the field of operation; this was ligated on either side of the midline and then cut through. Before opening the trachea 10 minims of a 5 per cent solution of cocain were injected into the trachea, as suggested by St. Clair Thomson, which absolutely abolished any reflex cough upon the introduction of the tracheotomy tube. The division of the alæ of the thyroid cartilage was carried out by a fine saw, beginning 2 mm. to the left of the middle line, and upon completing the exposure of the interior of the larynx it was found that the line was beyond any apparently invaded tissue.

The method of removal of the entire vocal cord, with the underlying perichondrium and arytenoid cartilage and the subsequent steps of the operation, were carried out as detailed by St. Clair Thomson and Irwin Moore. There was practically no troublesome hemorrhage following the removal of these structures. The alæ were next accurately apposed and maintained in this position by the drawing together of the separated muscles by deep buried sutures of catgut. The skin incision was closed above by sutures as far down as the level of the tracheotomy tube; below this it was left open.

The patient was returned to bed in good condition, and until recovery from the anesthetic lay on his right side with the head level. When recovery was complete the patient was placed in a semi-recumbent position and for twenty-four hours was given only sterilized water by the mouth.

Twenty-four hours after the operation, as no reactionary edema was found upon laryngoscopic examination, the tracheotomy tube was removed. As no difficulty was experienced by the patient in swallowing, he was allowed a gradually increasing generous diet, and upon the fourth day after the operation was permitted to sit up in a chair, leaving the hospital seventeen days after the operation.

Three weeks later it was noted that quite a mass of granulation tissue had made its appearance on the site of the removed right vocal cord, which was so large as to slightly obstruct his breathing. A 50 per cent solution of Argyrol was applied daily, with the result that the granulation gradually lessened and in six months had quite dis-

appeared, having resolved itself into a smooth, white band of cicatricial tissue, resembling to a slight degree a vocal cord, the so-called "cicatrix vocal cord" of Burger.

It is now two and a half years since the operation, and the patient has gained in weight and his voice has become so much stronger that it can be distinctly heard at a distance of 50 feet in a quiet room and he is able to carry on his work as a train dispatcher, his voice being heard distinctly at a distance of 160 miles through the telephone.

Pathological Report. The following is the complete pathological report of the specimen removed:

*Right Vocal Cord and Surrounding Mucous Membrane.* An irregular mass of brownish tissue, somewhat triangular in shape. One surface is covered by a mucous membrane while the other consists of friable brownish and blackish, shaggy tissue raised up into a cauliflower-like arrangement. Running along one free border is a wedge-shaped piece of whitish cartilage, some 2 cm. long by 8 cm. thick. The mucous membrane in its lower extent shows upon section a narrow bundle of whitish soft tissue lying in it and just below, and running up the specimen parallel to the cartilage. In its upper extent the mucous membrane is involved in an extension from the raised growth from the other surface; it is discolored, raised and ulcerated. Upon section of the lowe· surface the process is seen to be superficial and has not penetrated the deeper tissues, for these seem to be quite intact.

*Microscopic Examination.* The section shows large islands of actively proliferating squamous epithelial tumor cells, which in this section are not actually invading the structure lying beneath them. In type, however, they are young and supple. The mucous membrane covering the muscle lying below is swollen, and pale, and in places necrotic, while the submucosa is densely infiltrated with acute and chronic inflammatory cells.

*Diagnosis.* Squamous-cell carcinoma with secondary infection.

# LARYNGECTOMY FOR CANCER, WITH REMARKS ON SEVENTY OPERATED CASES

JOHN E. MACKENTY, M.D.

I am convinced, from personal experience, that the operation of total laryngectomy for the cure of intrinsic cancer of the larynx should take a foremost place in the surgery of cancer in general. In no other location in the body have the results excelled and in few have they even approached those in the field under discussion.

From this assertion the surface cancers might be excepted, since their less difficult and earlier diagnosis give surgery and radium an opportunity not secured to cancer in other and deeper parts. Though, technically speaking, cancer in the larynx may be classified as a surface disease, clinically on account of its hidden position and high malignancy, it deserves a place with the so-called deep-seated cancers.

The failure in the past to cope with this horrible death—and I can conceive of no ending more disgusting or more painful—was due to the inexperience of the general profession. An operative mortality of over 30 per cent and the high percentage of recurrence did not encourage either the surgeon or the patient to face the ordeal. A high degree of supineness fell upon the profession expressing itself in pessimistic utterances often, I regret to say, from those who should have been foremost in leading the fight. The loss of voice incident to the removal of the larynx was a stumbling-block to both doctor and patient. They seemed to ignore the fact that loss of voice was inevitable in the progress of the disease coming long before its fatal termination.

Coupled with this was an almost total ignorance on the part of the public of the one very simple manifestation of laryngeal cancer, *i. e.*, hoarseness or change in the quality and character of the voice in the middle years of life. If this one simple mani-

festation could be branded on the consciousness of the practitioner and of the public alike, thousands of cancer victims could be saved yearly.

If we except the rare fulminating malignancies in which all effort is generally futile, intrinsic cancer of the larynx is in its beginnings, and often in its more developed stage, still a local disease. It is cut off to a considerable degree from the lymph channels of the neck by a cartilaginous wall which acts for a time as a barrier to extension. Two vulnerable directions of extension exist: One backward toward the esophagus and one upward toward the epiglottis and lateral hypopharynx. Rarely in the early stage does the disease extend directly through the cartilage to the tissue of the neck.

After many years of observation and operative effort in this field one can with fair precision prognosticate the ultimate result in any given case.

The factors tending toward an optimistic outlook may be set down as follows:

1. Slowness of growth.

2. Freedom from involvement of the posterior part of the larynx.

3. Superficial growth. Cancers starting in the deeper layers of the larynx may not be more malignant, but they often escape detection until well developed.

4. Extension forward and downward rather than upward and backward.

5. Age of patient. Cancer in the late thirties or early forties is more malignant than in later life.

Arytenoid involvement, in my opinion, places the disease on the borderline of the extrinsic class and tremendously lessens the hope of cure. Biopsy for diagnosis is to be avoided if possible. It has been resorted to only a few times by me in eighteen years, principally where syphilis masked an underlying cancer. In these luetic cases the suspicion of malignancy was confirmed by biopsy.

The diagnosis should be made on the history, appearance, behavior of the growth, and on the exclusion of syphilis and pulmonary tuberculosis. It may seem trite to state that the

loss of motility in the affected cord is almost a pathognomonic symptom of cancer. This is due to fixation of the musculature by infiltration. The disease attacks one or the other cord, generally in the middle third. I have seen no primary involvement of the interarytenoid space so characteristic of tuberculosis. The Leitz arc lamp is of great assistance in securing a clear definition of the disease.

The extent of the growth must not be estimated by the image seen in the laryngeal mirror or even by the more accurate impression secured by direct laryngoscopy. The upper edge of the growth is all that appears for inspection, the extension downward and inward being hidden from view. Growths of deep origin are the most deceptive. I believe that it would be quite safe to add two-thirds to the visible growth in forming a mental picture of its size.

Formerly when in doubt on the extent of the disease I advocated opening the larynx for better orientation. I am now opposed to this procedure and believe that it should be avoided, since the incision may bisect the growth and disseminate it. Furthermore this procedure may and often does let blood into the trachea and adds just that much more to an already serious and dangerous operation.

If doubt exists in the operator's mind as to the extent of the growth the patient should be given the benefit of that doubt in having the more radical operation done.

It is my firm belief, founded on experience, that only the most incipient cancers should be treated by any method other than the most radical.

Statistics will bear me out in asserting that secondary operations for cancer are almost futile in any field. You have but one shot for a bull's eye, and if you miss the patient pays with his life.

Therefore I assert that if we are to get anywhere with this terrible disease we must divorce our minds from a lot of sentimentalism born mostly of inexperience relative to the so-called pitiable plight of the laryngectomized patient. I have been in intimate contact with these so-called victims for years, have seen them in their business and social lives, and have observed nothing but cheerfulness and gratitude on their part at their deliverance

from certain death. My experience is leading me yearly further away from compromise in dealing with intrinsic cancer of the larynx. It has also taught me to leave the frankly extrinsic cases to their fate. For five years I have so stood. The extrinsic cases done prior to that time have all since died of cancer, so have many of the thyrotomies window resections and hemilaryngectomies.

Here I might digress and say a word on some amazing statistics of cures by thyrotomy and even by excision under suspension. Is it possible that the general profession in the regions from which these statistics emanate is more enlightened and more alert in the detection of laryngeal cancer than we are in New York and its environs? To believe this would surely be unpatriotic even if it were not very improbable. Why do we in New York so rarely encounter the incipient case seemingly so common elsewhere? If total laryngectomy on early intrinsic cases has cured in my hands say 66 per cent, why does thyrotomy and suspension excision yield in other hands even a larger percentage? If true, then the part must be greater than the whole.

The question must arise in the unbiased mind, Are we laryngologists facing the surgical facts in dealing with laryngeal cancer or are we compromising with the patient's fears and desires?

Surgery in other fields for cancer strikes wide of the disease. Do you believe that the general surgeon would be content with a quarter of an inch leeway on a malignant growth or feel that he had accomplished his duty in so operating? Those who advocate thyrotomy and suspension removal for the majority of laryngeal cancers seen by them must be operating with even less than a quarter of an inch leeway.

We laryngologists have much to atone for in our past. Witness the long and fruitless discussion on the relative merits of tonsillectomy *versus* tonsillotomy. Think of the years it has taken to place sinus disease where it now stands. Do you realize that thousands of submucous resections and partial or total turbinectomies are even now being done for nasal obstructions due solely to sinus disease and tonsillar infections? It looks as though we are learning little from the past and are still stuck in the mire of tradition on this question of the best method of dealing with

laryngeal cancer. My personal position on this question is that thyrotomy is rarely indicated, that radium is on trial, and that total laryngectomy is the logical safe-and-tried procedure of choice.

Statistics. Six hemilaryngectomies were done prior to 1916-17: 2 are now living; 4 died of recurrence within two or three years of the onset of the disease; the 2 surviving cases were operated at a very early stage. I now know that the others should have had a total laryngectomy, as they were not incipient cases as I now understand the term.

Thirteen total laryngectomies were done prior to 1916-17: 2 of these were diabetics and succumbed to the operation; 6 were advanced intrinsic cases with involvement of one or both arytenoids; 4 of the 6 died of recurrence; 2 are still living; 3 were intrinsic cases (arytenoids free); 1 of these cases died from a recurrence, 1 from nephritis one year after operation, and 1 is still living.

The extrinsic cases with involvement of the arytenoids, the anterior lip of the mouth of the esophagus or the glands of the neck have all died of recurrence.

Twenty thyrotomies were done between 1906–1920: 8 of these had the growth removed, leaving the cartilaginous wall; 7 died of recurrence, 1 is still living. In 1911 the window resection was taken up and 12 were operated on by this method: 8 of these had recurrences and died; a subsequent total laryngectomy failed to save 3 of the 8; 4 are still living, 2 after three and two and a half years. Looking back upon this series I am convinced that but few of these 20 cases were subjects for anything short of total laryngectomy. With my present experience several might have been saved by the more radical operation, since many of them were well beyond the incipient stage, yet intrinsic. Since 1916–17 only 2 thyrotomies have been done, both on extremely early cases. As stated above they are still living without recurrence after two and a half and three years.

Since 1916–17, I have seen 143 cases of laryngeal cancer: 46 of these were still intrinsic and gave some hope of permanent cure. The disease was confined to the laryngeal box; the arytenoids were partially involved or not involved at all; 3 cases were

truly incipient and might have been suitable for thyrotomy; in the 97 remaining cases the disease had extended beyond the larynx in various directions. In many the glands of the neck were palpable. Out of the 48 intrinsic, 31 cases came to operation for total laryngectomy and 2 for thyrotomy. In these 33 cases there were no surgical mortalities. There have been no operative deaths since the two reported five years ago. Twenty-nine were done by the one-stage operation; 2 by the two-stage operation. Twenty-five have entirely discarded the tracheal cannula, an advantage rarely experienced in the two-stage operation.

One case of sarcoma appears in this series. The oldest case was eighty, the youngest forty-one. Two were females. Primary union was secured in only five. A large defect occurred in two, requiring a subsequent plastic. Since three years no plastics have been necessary, owing, I believe, to improvement in the operative technic and to better management of the postoperative infection.

The series reported in 1916–17 were mixed cases, some advanced and some early. The 33 cases since that date are all fairly early cases. All extrinsic cases were rejected, for the good reason that in ten years of surgical effort, from 1906 to 1916, I had not succeeded in ultimately saving one. I am convinced that all extrinsic cases of cancer of the larynx cannot and never will be curable by surgery.

Twenty-six of the 33 cases are still alive with no evidence of recurrence; 1 died at eighty-four years of age of pneumonia; 1 died two years after the operation of cerebral hemorrhage. One of the most hopeful died of recurrence three years after the operation and 4 cases in which the disease was well back toward or partially involving the arytenoids have succumbed to recurrence within two and a half to three years from the time of operation; 14 cases out of 18 show no recurrence after a period of from three to five years.

If 5 more cases in this series of 33 should succumb to cancer, making in all 10 cancer deaths in 33, we would still have a percentage cure of 66 per cent, a showing quite worth the effort.

Technic. Since my last publication on this subject, over five years ago, the operative technic has been improved in several

points, though the *rationale* of the operation is essentially the same. The troublesome plastic repair for closure of the hypopharyngeal defects in the earlier cases has been almost entirely eliminated in the latter ones. Convalescence has been materially shortened. Though some infection in the wound is the rule, I do not now so often see the extensive gangrenous sloughing which made a few of the earlier cases so difficult. In 31 consecutive total laryngectomies and 2 thyrotomies neither mortality nor serious complications have occurred. The shortest wound healing was ten days and the longest five weeks; 29 were done by the one-stage operation; 2 required a preliminary tracheotomy; 25 have been able to dispense with the tracheal cannula; in 3 it must be retained, since the tracheal opening collapses when the tube is removed; 3 could dispense with the cannula, but fear to do so.

The two-stage cases cannot dispense with the cannula, as the tracheal rings at the opening were destroyed by the tracheotomy. To secure a tracheal and skin union with the tracheal ring immediately beneath is one of the aims of the one-stage operation. This gives a rigid opening, dispenses with the cannula and adds immensely to the patient's future comfort. After no two-stage operation have I seen this result secured.

I have been much gratified with the speech results. All but one of the cases have developed a whisper audible at from two to six feet in a still room. One operated seven years ago has acquired loud speech and can talk over the telephone. He can count up to twenty on one stomach full of air. In some way, known only to himself, he opens his esophagus, fills his stomach with air, and makes audible speech by expelling the air slowly. Several are engaged in large enterprises which they conduct as successfully as they did before their operation. Some have informed me that their stenographers take their dictation with ease. They do not complain of discomfort during the cold months, not even in Canada. To protect the lungs against cold dry air a bulging wire screen covers the tracheal opening and extends several inches down and across the chest. Above this a high soft collar is worn to exclude the external air. The patient breathes the warm, moist air coming from beneath the clothing. This simple

device has done much to protect the trachea and lungs during the cold months.

The surgical period may be divided into three stages:

1. The preparation.
2. The operation and its technic.
3. The after-treatment.

1. *Preparation.* Two deaths have occurred in seventy operations. These were among the earlier cases before a rigid examination and preparation were instituted. These deaths were due to sugar retention. One was a frank diabetic and was treated by the more or less crude method then at our disposal.

The false assumption was that a sugar-free urine put the patient in a safer operative state. He died of an ischiorectal infection, three weeks after operation, secondary to a general septicemia. The other death occurred in an individual with a normal urine. The history pointed to a glycosuria occurring two years previous to the time of operation. The condition following operation pointed to diabetes. A blood chemical examination revealed retention with a high sugar index. He died of a septic bronchopneumonia.

The lessen learned from these deaths has since saved several cases from a similar fate. This leads up to the first point in the period of preparation. The patient is put in the hands of a metabolist who sees that he is chemically balanced. If retention exists, especially of sugar, treatment is instituted. If sugar cannot be brought to a safe level the case is rejected. Several cases have thus been brought through which under less careful treatment might have succumbed. It is gratifying to observe that this procedure is now extending to all branches of surgery.

Where the heart is weak, digitalization is a very essential part of the preparation. Special attention is paid to the colon. For one week preceding the operation, every other day, a weak carbonate of soda enema is given, followed by a saline colon irrigation. A low protein diet, excluding eggs, beef and sweet milk, is essential in all cases for a week or two preceding the operation.

A competent dentist extracts all carious teeth and pyorrheal teeth and cleans those remaining. So essential is this that it

should be entrusted to only the most expert and conscientious. Where all teeth are absent a primary union in the wound may be expected. The neck infections from a filthy mouth may take on the picture (so seldom now seen in surgery) of hospital gangrene. It occurred in a few of the earlier cases. Healing after such an infection leaves a tremendous gap in the throat and has in several cases required an extensive plastic for repair.

Before undertaking a plastic repair the wound must be entirely clean and cicatrized. Impatience to secure a quick closure dooms the whole procedure to failure. It is also essential to use local anesthesia, since the vomiting incident to a general anesthesia is very liable to cause infection.

Adhering to these principles I have succeeded in closing the defect in all cases in one operation. The feeding tubes must be used as described in the first operation. If sinus disease exists every effort should be made to make the nasal cavities as clean as possible, not by operative methods, since this but stirs up a latent infection, but by suction and suction douche twice daily during the period of preparation. It is some consolation to know that many of these old sinus infections are not very virulent.

It is my custom to give bicarbonate of soda for a few days preceding the operation.

2. *The Operation and its Technic.* The surgical principles to be kept in mind may be taken up under the following headings:

(*a*) Anesthesia.

(*b*) The prevention of the inhalation of blood.

(*c*) Cleansing and disinfection of the mouth, pharynx, nose, hypopharynx, and the prevention of their secretions from contaminating the wound.

(*d*) The secure anchoring of the tracheal stump.

(*e*) Drainage.

(*f*) Method of closing the wound.

(*g*) Method of excluding the wound from the tracheal secretions.

(*h*) The proper placing and securing of the feeding tube.

*Anesthesia.* A combination of local and general anesthesia is, in my opinion, better than one of these alone.

By this method the duration of the general anesthesia is reduced

to one-half hour, an important factor in the resistance of the patient.

Where the growth encroaches upon the breathway the giving of the general anesthesia from the start may increase the embarrassment and force a tracheal opening before the surgeon is ready. If the patient becomes cyanosed and is not promptly relieved the consequent lung hyperemia may predispose him to a postoperative pneumonia. Hence the advantage of skeletonizing the larynx and upper two or three tracheal rings under local anesthesia before the general anesthesia is given; 1 per cent novacaine is used for the skin and 0.25 per cent for the deeper structures. To this is added a very minute amount of adrenalin.

The T-incision is used. It has many advantages over the linear incision. In fat necks it is indispensable. It lends itself better to drainage. The angles where the lines cross can always be made to heal by primary intention, thus preventing postoperative fistula by closing the upper central portion of the wound.

The dissection is carried backward until the larynx and trachea are skeletonized. When hemostasis is complete and all vessels tied the patient is given a general anesthetic. The trachea is now cut across just below the cricoid, taking minute care that no blood enters the lumen of the tube. It is an advantage to inject between two rings into the trachea before dividing it a few drops of 10 per cent cocain solution. This prevents coughing. The larynx is lifted forward and the posterior wall of the trachea is incised down to the esophageal wall. A rubber tube which fits snugly into the tracheal lumen is inserted into the trachea to a distance of about two inches. This acts as a tracheal extension, turns back the blood, and enables the anesthetist to continue his anesthesia without being in the way.

The larynx is separated from the esophagus from below upward to a point behind the arytenoids. Then it is allowed to fall back into position and the thyrohyoid membrane is divided, opening into the hypopharynx just below the attachment of the epiglottis. Before this opening is made the anesthetist or an assistant opens the mouth wide, sucks out all secretion, and paints the entire cavity of the pharynx and the hypopharynx with a 2 per cent

solution of mercurochrome. Iodin on the mucous membranes causes desquamation and predisposes to infections. The nasal cavity is similarly treated.

The edges of the opening through the thyrohyoid membrane are grasped and held apart. A yard of gauze folded two inches wide is stuffed into the hypopharynx and crowded upward until it fills the mouth and pharynx. At this point a careful inspection is made of the growth. If it is found to be entirely intrinsic the larynx is removed by cutting as close as possible to the superior border of the thyroid cartilage. The opening thus made in the hypopharynx is small and better lends itself to successful repair. If the disease has approached the top of the laryngeal box or has involved the arytenoid then more tissue is sacrificed, even to the removal of the anterior esophageal wall adherent to the posterior surface of the larynx. In several cases one to two inches of this anterior part of the esophageal lumen has been taken away with the larynx without producing subsequent stricture.

Just before the last stitch is tied in the closure of the hypopharynx the anesthetist removes through the mouth the gauze packing filling the mouth and the pharynx. The mouth and pharynx are again cleansed by suction and again painted with a solution of mercurochrome (2 per cent). A feeding tube of a size which will pass through the nose without undue pressure is passed through the more open side of the nose. When its point appears in the esophagus beneath the untied stitch the surgeon directs it into the esophagus to a depth of six inches. The point of exit from the nose is now carefully marked and the tube secured to the face by adhesive plaster.

The last stitch is now tied. If the redundancy of the tissues permits a second layer of stitches is placed over the first in the hypopharyngeal closure. No. 1 plain gut is used.

The trachea is anchored to the skin of the neck by two or three stay sutures, each passed around a ring and brought out about one inch from the edge of the wound. These are tied on small perforated lead disks. This steadies the tracheal stump in the wound and relieves the strain upon the stitches which are to unite the skin edges with the mucous membrane of the trachea. To make this union more exact the fat along the wound edges on

both sides is cut away. This allows the skin to fall more easily into relation with the edge of the tracheal stump. The skin strip and edge of the trachea are united by interrupted stitches, using fine silk or, better, fine equisetene. The wound is loosely closed, no effort being made to bring the deeper parts into anatomical order. It is essential to get primary union at one point, that is where the two lines of the T cross. I have observed that if the integrity of this part of the wound can be maintained the subsequent healing is much more rapid and hypopharyngeal fistula does not occur. If this point breaks away or, for the securing of better drainage, has to be opened an effort should be made as early as seems prudent to again bring those angles of the T into place. Silver wire here serves better than any other suture material, since it may be left *in situ* for a long time even in the presence of infection.

A tube and gauze drain are passed into the depth of the wound at the ends of the bar of the T. Just above the point where the trachea is secured to the skin two small gauze drains are placed, one on either side. This guards the direct route of the mediastinum.

A large tracheal cannula (No. 36) is wound with gauze impregnated with bismuth paste. The winding is so fashioned as to form a conical cork. This is inserted into the trachea and should fit as a cork does a bottle. The object of this corking the trachea is to prevent tracheal secretions from contaminating the wound from below and to turn back from the trachea any wound secretions from above. It also protects the tracheo-skin union. It has been in my hands a very serviceable device, especially later if infection arises and wound drainage becomes profuse. Without this tracheal plugging lung infection would be almost inevitable.

The wound is dressed in the usual way. A rubber apron is placed over the end of the cannula and catches all tracheal secretions.

During the repair period of the operation the patient is given little or no anesthetic. Deep anesthesia is imperative only from the time the trachea is opened until the hypopharynx and esophagus are closed.

3. *The After-treatment.* The immediate treatment usual after any major operation is carried out. I will speak only of the conditions peculiar to this operation. It is here that the skill and experience of the surgeon are often taxed to and even beyond their limit. The after-treatment in laryngectomy cannot be delegated to an assistant or a member of the house staff. Painstaking, constant care on the part of the surgeon is the only key to success. If infection occurs the surgeon must be at least one jump ahead of it. The reverse means almost certain death to the patient. I attribute the prohibitive surgical mortality of a few years ago in laryngectomy to four causes, viz.: Careless preparation of the case, prolonged general anesthesia, carelessness in the prevention of blood entering the lungs during the operation, and mismanagement of the septic infection so common after operation. Another factor may be added: Rectal feeding and drop-feeding by the mouth were depended upon prior to my demonstration that the esophagus would tolerate a permanent tube for weeks. Rectal feeding was one of the greatest fallacies that ever became rooted in the professional mind. It died a very long, hard death, and I, for one, sincerely hope that it is dead indeed and forever.

The local reaction in the neck is considerable and may simulate infection. If doubt exists in the surgeon's mind he would do wisely to extend as widely as possible his drainage openings and keep a wary eye out for extension along the muscular planes of the neck. If this occurs it must be followed and opened widely.

Later, if pus becomes profuse and if a break takes place in the esophagus, suction to remove these secretions is of inestimable value. Tubes are placed at the bottoms of the pockets and through the opening in the esophagus. These project through the dressing and the nurse applies suction to these tubes as frequently as is indicated. Dakin's solution has been useless in these cases, since it may get into the trachea and cause intense irritation. I prefer a 2 per cent mercurochrome solution used sparingly.

If, as sometimes happens, tracheitis follows the operation, suction applied through a catheter unloads the trachea and may prevent gravitation pneumonia. With the larynx gone normal

expulsive cough is obliterated, hence the impossibility on the part of the patient of unloading his trachea and bronchi. Here suction carefully and properly applied has, in my hands, saved many lives, not only in this operation but in all conditions in which the trachea is open and the bronchial tree loaded with secretion.

*Feeding.* Much of our success in piloting these cases across the postoperative period is due to the permanent feeding tube. Feeding to the point of toleration discourages septic infection. Of what avail are the feeble efforts of the surgeon against infection in a starving patient? For over twenty years I have used this method of feeding without one untoward result traceable to its use.

At first, expecting esophagitis, I used it gingerly and for short periods. I could get no information on the subject excepting that all seemed afraid of it. In Vienna, in 1911, it was not used and the men in this work advised against it. The drop method of feeding was employed. They would not discuss its merits with me or be influenced by the years of my practical experience, as I was an American.

Feeding is begun just as soon as the anesthetic period is over. For two days from one-half to two-thirds the calorie requirements are given, then the amount is increased to tolerance.

Any well-balanced diet capable of being reduced to a fluid or semisolid may be used. I append two diet lists founded on the calorie requirements of a normal individual of average weight. Fruit and vegetable juices are essential and must not be kept out of the dietary longer than five or six days. Gravitation serves for ordinary liquids. For thicker ones the piston syringe may be used. The patient being propped up in bed the food is very slowly introduced. After each feeding (which may be once in two and a half to four hours) a few ounces of water are passed through the tube to cleanse it. Several times a day the pharynx is cleansed of mucus by suction and the mouth and teeth cleansed with a mouth-wash and a brush. Dressings are changed as often as need be to keep the wound free from secretions. In foul cases the wound packing may require several changes in twenty-four hours. The patient must be shifted from side to side and encouraged to sit propped up in bed.

DIETARY FOR LARYNGECTOMY PATIENT. MAN, 150 LBS., 1900 CALORIES.

| Grams. | | Carbohydrates, 115. | Proteins, 100. | Fat, 115. | Vitamines. | Bases. | Acid bases. | NaCl. |
|---|---|---|---|---|---|---|---|---|
| 8 A.M. | | | | | | | | |
| 120 | Orange juice | 12.0 | 6.0 | .. | +++ (3) | 4.5 | .. | .0203 |
| 1 | Egg | .. | 6.0 | 6.0 | ++ (1) | .. | 7.5 | .302 |
| 4 oz. | Water | | | | +++ (3) | | | |
| 10 A.M. | | | | | | | | |
| 120 | Oat meal gruel | 7.6 | 1.5 | 0.5 | ++ (1) | .1 | .. | .114 |
| 60 | Cream, 40 per cent | 2.0 | 2.0 | 24.0 | ++ (1) | 2.0 | .. | .0782 |
| 120 | Whole milk | 6.0 | 4.0 | 4.0 | + (2) | .. | .. | .21 |
| 10 A.M. | | | | | + (3) | | | |
| 12 N. | | | | | | | | |
| 120 | Jellied beef soup | 3.0 | 12.5 | 1.4 | | | | |
| 10 | Butter | .. | .. | 8.5 | +++ (1) | .. | + | |
| 15 | Gelatine, granulated (heat and add water to make 8 oz.) | .. | 14.1 | | | | | |
| 2 P.M. | | | | | | | | |
| 120 | Orange juice | 12.0 | .. | .. | +++ (3) | 4.5 | .. | .0203 |
| 1 | Egg | .. | 6.0 | 6.0 | ++ (1) | .. | 7.5 | .302 |
| 4 oz. | Water | | | | +++ (2) | | | |
| 4 P.M. | | | | | | | | |
| 120 | Jellied beef soup | 3.0 | 12.5 | 1.4 | .... | .. | .. | .0792 |
| 60 | Cream, 40 per cent | 2.0 | 2.0 | 24.0 | ++ (1) | .. | + | |
| 15 | Gelatine, granulated prepared as above | .. | .. | 14.1 | | | | |
| 6 P.M. | | | | | | | | |
| 120 | Oat meal gruel | 7.6 | 1.5 | 0.5 | ++ (1) | .. | 3.0 | .114 |
| 120 | Whole milk | 6.0 | 4.0 | 4.0 | + (2) | 2.6 | .. | .21 |
| 30 | Cream, 40 per cent | 1.0 | 1.0 | 12.0 | + (3) | .1 | .. | .0396 |
| | | | | | ++ (1) | | | |
| 8 P.M. | | | | | | | | |
| 120 | Prune juice | 20.0 | 1.0 | .. | .... | 25.0 | .. | .42 |
| 2 | Whites of eggs | .. | 3.0 | .. | + | .. | 9.5 | .30 |
| | Water ad lib. | | | | | | | |
| 10 P.M. | | | | | | | | |
| 240 | Whole milk | 12.0 | 8.0 | 8.0 | ++ (1) | 2.6 | .. | .42 |
| 10 | Cocoa | 3.7 | 2.0 | 3.0 | + (2) | 0.1 | | |
| | | | | | + (3) | | | |
| 2 A.M. | | | | | | | | |
| 90 | Orange juice | 9.0 | .. | .. | .... | 4.5 | .. | .0203 |
| 1 | White of egg | .. | 3.0 | .. | +++ (3) | .. | 9.5 | .15 |
| | | | | | + | | | |
| 6 A.M. | | | | | | | | |
| 120 | Oat meal gruel | 7.6 | 1.5 | .5 | .... | .. | 3.0 | .114 |
| 30 | Cream, 40 per cent | 1.0 | 1.0 | 12.0 | ++ (1) | .1 | .. | .0396 |
| | Water ad lib | 115.5 | 103.9 | 115.8 | | 46.8 | 43.0 | 3.2768 |

## IMPORTANT.

That enough lean beefs and bones be used in making Beef soup, so thatwhen strained and set in the ice box, it will jelly.

That all liquids, in the above dietary, be carefully strained just before giving them to the patient.

30 grams equal 1 ounce
30 cc equal 1 ounce
5 grams equal 1 level teaspoonful.

For "Salt Free" diet, use the above Dietary, omitting *all* salt from soup and gruels and using salt free butter.

FEEDING FOR LARYNGECTOMY PATIENT.

| | Grams. | | Carbo-hydrates. | Pro-teins. | Fat. | Carbo-hydrates. | Proteins. | Fat. | Vitamines. |
|---|---|---|---|---|---|---|---|---|---|
| 8.0 AM. | 129 | Oat meal gruel | 7.6 | 1.5 | .5 | .. | .. | .. | +++ (1) |
| | 15 | Butter | .. | .. | 12.8 | .. | .. | .. | ++ (1) |
| 10.00 A.M. | 60 | Cream, 40% | 2.0 | 2.0 | 24.0 | | | | |
| | | | 9.6 | 3.5 | 37.3 | | | | |
| 6.30 P.M. | | Repeated | 3 | 3 | 3 | | | | |
| | | | 28.8 | 10.5 | 111.9 | | | | |
| | 1 | Egg | .. | 6.0 | 6.0 | | | | ++ (1) |
| | | | 28.8 | 16.5 | 117.9 | 28.8 | 6.5 | 117.9 | +++ (2) |
| | 15 | Rice (raw) | 8.9 | .2 | .03 | .. | .. | .. | ++ (1) |
| | 60 | Cream, 40% | 2.0 | 2.00 | 22.00 | .. | .. | .. | ++ (1) |
| 12.00 N. | 1 | Egg | .. | 6.00 | 6.00 | .. | .. | .. | +++ (2) |
| | | | 10.9 | 8.12 | 30.03 | 10.9 | 8.12 | 30.03 | |
| | 10 | Ovaltine | 6.8 | 1.4 | .8 | .. | .. | .. | + (2) |
| 2.30 P.M. | 120 | Whole milk | 6.0 | 4.0 | 4.0 | .. | .. | .. | + (3) |
| | 60 | Cream, 40% | 2.0 | 2.0 | 24.0 | | | | |
| 4.30 P.M. | | | 14.8 | 7.4 | 28.8 | | | | |
| | | Repeated | 3 | 3 | 3 | .. | .. | .. | ++ (1) |
| 4.30 P.M. | | | 44.4 | 22.2 | 86.4 | 44.4 | 22.20 | 86.4 | |
| 10.00 P.M. | 10 | Ovaltine | 6.8 | .4 | .8 | | | | |
| | 120 | Whole milk | 6.0 | 4.0 | 4.0 | .. | .. | .. | ++ (1) |
| | | | 12.8 | 5.4 | 4.8 | .. | .. | .. | + (2) |
| 2.00 A.M. | | Repeated | 2 | 2 | 2 | .. | .. | .. | + (3) |
| | | | 25.6 | 10.8 | 9.6 | 25.6 | 10.80 | 9.6 | |
| 6.00 A.M. | 15 | Malted milk | 9.5 | 2.3 | 1.2 | 9.5 | 2.30 | 1.2 | |
| | | | | | | 119.2 | 59.92 | 245.3 | Total |
| | | | | | | 4 | 4 | 9 | Calories |
| | | | | | | 476.8 | 239.682 | 206.68 | |
| | | | | | | | | 239.68 | |
| | | | | | | | | 476.80 | |
| | | | | | | | | 2922.65 | Total Calories |

Using 20 per cent cream instead of 40 per cent, gives 161.13 fats and 2,162.65 calories.

Complications. 1. *Pneumonia.* The entrance of blood into the lungs during operation and prolonged deep anesthesia are the two most noteworthy causes of pneumonia. One case of bronchopneumonia occurred in my series. It was in a diabetic, and proved fatal.

2. *Mediastinitis.* This is said to be one of the dangers of this operation. It has not appeared in my cases. Liberal drainage at the time of the operation and free opening of the wound at the onset of infection must materially minimize this danger.

3. *Extensive gangrenous sloughing of the wound* may produce great debility but has not in my experience caused death. On the other hand it has perhaps saved life by eradicating more efficiently than the knife any wandering cancer elements in the neck.

4. *Hiccough.* A troublesome hiccough has occurred in four of my cases following total laryngectomy. In only one did it develop a serious aspect. In this case small doses of apomorphin controlled it after all other means failed. It is probably due to irritation of the vagus nerve in the operated field.

5. *Hemorrhages.* Secondary hemorrhage immediately following operation is due to a defective technic on the part of the surgeon. I have made it a rule that all clamped points in operation in the neck must be tied. If a good pedicle cannot be secured for tying then a transfixion stitch is used. Secondary hemorrhage from sloughing rarely occurs from a large vessel, since the walls of the larger vessels are very resistant to infection. It is easily controlled and not serious unless prolonged. There is a type of secondary hemorrhage in healing wounds just past the septic stages which is extremely difficult to control. Septic absorption so changes the chemistry of the blood as to convert the patient into a temporary bleeder. The blood becomes thin and clots poorly. In this state of the patient the granulating surface of the wound may bleed profusely. The granulations at the point of bleeding should be curetted away and the patient transfused. Perhaps repeated small transfusions act better than one large one. I have witnessed this complication in one case recently. It did not yield to transfusion. The bleeding lasted for two weeks, the hemorrhages occurring about three times in twenty-four hours. It was finally controlled by the

complete removal of the overactive granulation tissue in the wound.

6. *General Sepsis.* One case in my series died of general sepsis. He was a diabetic. He died three weeks after the operation from an ischiorectal abscess and gangrene of the peroneum.

7. *Tracheitis.* A mild degree of tracheitis is frequently observed after laryngectomy. Rarely this may be severe enough to threaten the lungs and produce a secondary bronchopneumonia. It is here that suction to clear the trachea and upper bronchial tree from secretion is of invaluable aid.

The fight to place laryngectomy on a firm basis both from a surgical and a life-saving standpoint has been an uphill struggle. We have been hampered by an apathy on the part of the profession engendered by the prohibitive surgical mortality in the past and an almost hopelessly large percentage of recurrences.

Prominent men in our midst have decried the operation, since failing themselves in its successful performance they could not conceive of its success in other hands. Hopeless cases, often in the septic stage of the disease, were operated and forced to pass through two deaths instead of only one had they been let alone.

Radium in the hands of the unscrupulous and the unscientific has beguiled the poor victims to their doom and deprived them of their only chance, an early and radical operation. Scientific observers, like Dr. Quick, have made no extravagant claims for radium in this disease.

Partial removal of the larynx or attempts to remove the growth by thyrotomy or suspension in cases entirely unsuited to these procedures have heaped discredit upon the whole procedure.

Finally there has been the failure of the profession at large to realize that prolonged hoarseness in a person of cancer age may be, and very often is, the first sign of danger demanding immediate, intelligent and painstaking investigation by one competent to differentiate between the simple and malignant disease in this field. If cancer has its inception external to the laryngeal box its early detection must be, until more light on this disease is vouchsafed us, of little avail to the victim. In my opinion we are helpless in this solution. Hence the only cases in which early detection is of importance are those (the intrinsic) in which hoarseness may be an early symptom.

Permit me in closing to reiterate two statements: Incipient intrinsic cancer of the larynx is a very hopeful disease if we apply to its cure the same horse sense exhibited by the general surgeons in the treatment of cancer elsewhere in the body. The general surgeon operates radically. The laryngectomized patient is not, as many state, only a surgical curiosity, a derelict, a miserable thing apart from all his kind. He is usually a useful, active citizen, capable of continuing his lifework, of supporting his family, and realizing if not to its full extent at least to a large extent the joy of living.

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## Discussion on the Papers of Drs. Okada, Jackson, Birkett and Mackenty

Dr. D. Bryson Delevan, New York:

First, let me express my own feeling and yours in complimenting our distinguished and very welcome guest, Prof. Okada, upon his admirable contribution which, with the other theses presented, marks a real advance toward a more definite knowledge of this distressing subject.

In considering the unsolved problems of laryngeal cancer the time has certainly arrived, not for the theoretical discussion of rival methods but for the actual comparison of their practical results.

Watson, of Edinburgh, in 1866, first performed the operation of laryngectomy. Since then in many lands many surgeons have operated upon innumerable patients. Surely by now the knowledge to be derived from this widely spread experience of half a century should be made to crystallize in order that we may discover whether we are still running in circles or that actual progress is being made. The value of this symposium is such as to indicate a real advance.

The excellent results obtained by Prof. Okada are particularly encouraging. The thing which appeals especially to me is the breadth of view with which he considers the choice of operation, recommending the careful study of the case and selection of the operation with reference to its particular characteristics. This one point is worthy of thorough discussion. Not only may laryngeal neoplasms differ histologically, but growths of the same type may show great variations of malignancy and of rate of development, things which materially

affect the prognosis and in some measure account for the widely differing results following the similar treatment of growths apparently identical. Improvements in the methods of diagnosis which would admit of a clearer vision of the probable course of the growth would add greatly to the possibilities of successful treatment. Without question, the past twenty-five years have taught that in the surgery of laryngeal cancer no single method has borne off all of the honors. There still remains a decided possibility of choice. Prof. Okada has done well to emphasize this and to raise the question: Should all cases of laryngeal growth of suspected malignancy be operated upon in the most radical manner, or should discrimination be made and in certain cases more conservative means be employed? The time has come when, with the statistical material at hand, the question whether thyrotomy, in properly selected cases, will not give completely satisfactory results should be carefully weighed. Following the lead and direction of Sir Henry T. Butlin, many operators, including Sir Felix Semon, Sir St. Clair Thomson in England and many others here and abroad have with thyrotomy obtained excellent success. As an example, among other cases in my own experience a patient from whom two-thirds of the larynx had been removed for an intrinsic epithelioma appeared at my office recently to celebrate the twenty-fifth anniversary of his recovery.

Again, I have under observation a lady who required an extensive removal of the entire larynx and surrounding tissues for an epithelioma which, beginning at the posterior commissure, had extended well outside of the larynx. There has been no sign of recurrence for six years. The operation was performed by the late Dr. Henry H. Janeway after the method of Dr. J. Solis-Cohen, so graphically displayed by Dr. Mackenty, namely, the fixation of the trachea at the base of the neck. Dr. Cohen's first patient was apparently well eleven years after operation. Both of these cases acquired excellent power of phonation, as is usual with patients of fair intelligence.

Dr. J. Solis-Cohen established several principles of great value. One was the management of the trachea, as indicated above. Another, and most important, was the value of scrupulous, painstaking, and untiring care and watchfulness bestowed upon the patient after operation, not by the assistant nor by the intern nor by the nurse, but by the operator himself. Where these principles have been carried out there has been proportionate success.

I have quoted the two cases mentioned above to show that thyrotomy in milder conditions and laryngectomy, even in extensive disease, can give good results. Each method has its advocates and can

point to its successes. The discussion has been carried on for many years. By all means let it be continued to a definite conclusion, but let that conclusion be reached with all speed.

Prof. Okada emphasizes the importance of educating the general profession and the public in the early recognition of cancer, and especially of cancer of the larynx, and to that end urges that the general physician be instructed more generally in the use of the laryngoscope, by means of which a diagnosis might be made before the growth might otherwise have been suspected. The great movement now going on in this country under the efforts of the American Society for the Control of Cancer is making virtually this same endeavor, thus far with gratifying results.

As a means to diagnosis, biopsy with us is not generally recommended.

Dr. Jackson advocates many suggestions of distinct value and points the way to investigations promising much enlightenment. We cannot consider too carefully the proposition that inflammatory conditions in general, especially of a chronic nature, vocations and other influences which engender continued congestion of the larynx, abuse of the voice and other agencies similar in effect may become actively predisposing causes of the development of new growths.

Dr. Jackson refers to a certain action of the mind as "instinctial diagnosis." I would define this expression as a subconscious reasoning, based upon long experience of many closely observed cases. The beginner does not have the instinct for diagnosis. The man of long practice may acquire it. When instinct or intuition has caused him to believe that a certain condition is what it appears to him to be, it is a wise plan to respect that judgment until disproved.

Another valuable feature of Dr. Jackson's paper is the attempt of the author to profit by history. If he can inculcate the importance of this, can cause us to read more, to look backward and see what has already been done, I am certain that more suffering will be prevented, more lives saved. It seems that in this matter of laryngeal cancer, with few exceptions, men who have had their own experiences and who have learned their own lessons, if not succeeding measurably well, have failed to record their findings, thus allowing their work to be lost sight of. More than anything else there is need of a collective history, and analysis of this subject, failures as well as successes faithfully set forth. Thus it may be learned what methods to imitate, what to avoid and ultimately prove by what means human life is most likely to be prolonged.

The statement that cancer never develops in an apparently healthy

larynx is open to question. While true in general, exceptions seem now and then to occur. Several are recalled to my mind. The proposition that the cure of certain morbid conditions of the larynx and upper air passages in general will diminish the incidence of cancer is reasonable.

The improved care of the nasopharyngeal region in recent years has removed many sources of laryngeal irritation. Is the ratio of laryngeal cancer less today than it was forty years ago?

The value of silence is unquestionable, but hard to impress upon the patient. Far greater stress should be laid upon its importance.

The question whether a benign growth may degenerate into one of a malignant character has been extensively discussed, with negative results, following the historic tragedy of 1888.

There is much food for thought in Dr. Jackson's proposition that "there is a curable precancerous state if one could only recognize it." This, it seems to me, is the most important idea which has been presented to us. Under its influence we would do well to stimulate by all possible means the efforts of those engaged in the investigation of the etiology of this baffling disease.

Dr. Joseph Beck, Chicago, Ill.:

I was very much interested and learned a great deal from the presentation of the three papers. I had the fortune to meet our guest, Prof. Okada, previously, he having spent a few days in Chicago, when we talked this matter over very extensively, so that I know a good deal of the work he has done. He has promised me that when I visit Japan, as I expect to do this fall, I may see his work. I was favorably impressed by the very enthusiastic presentation by Dr. Mackenty, based solely on the personal experience that he spoke of. Even to this day I feel that I have not sufficiently heeded the instinctive feeling that I had, and which Dr. Delavan spoke of, of my performing laryngectomy instead of some less radical measures. Had I heard these words before I believe that I would have done many more laryngectomies than I have done, and had I done so I believe that many of the cases (certainly at least forty attempts by external operations) would have been saved. Another thing is this: I have seen, after many years, the laryngotomies accompanied with microscopic sections done by such great men as we have had in this country, England, and Austria, that I wanted to follow them. I now feel that I am going to be able to work a bit longer, and certainly shall do more laryngectomies. In the first place it is certainly an easier operation so far as the operator is concerned. The point was brought out that the patient should not

be conscious during a laryngectomy. The last moment of removal of the larynx is most concerned with that point: this for the reason that it is a dreadful feeling for the patient to hear, "Now it is out," or something to that effect. The question as to the choice of an anesthetic is a most important one, and if I may be permitted to speak of this, would say that I operated at least ten times on the larynx, including three laryngectomies, under the Gwathmey synergistic analgesia, as it is called. I believe that it is one of the best things I have tried for a long time. As you perhaps know it consists in the rectal administration of ether and paraldehyde in olive oil with a regular and timely administration hypodermically of morphin in combination with magnesium sulphate. The exact dosage of these agents is described in our recent report before the Chicago Otolaryngological Society. I have not had a single bad result in almost two hundred cases of otolaryngological interest, and laryngectomy is much easier of performance with the aid of this anesthesia. The patient is relaxed, and yet he will coöperate with you, even to the point of attempting to expel secretions and blood that may accidentally run into the trachea. Nothing has given us better results than having the patient swallow the duodenal tube for feeding purposes and keeping the outer end in the nose. Prof. Okada taught me one point in regard to the severance of the trachea which Dr. Mackenty spoke of, giving his reasons for deferring the sewing of it on until later. The Professor anchors it immediately; the idea of so doing is to prevent the dropping back of the trachea and being drawn down into the chest. I think that is a point, even though perhaps the tube Dr. Mackenty showed may avoid this drawing in. In regard to Dr. Jackson's paper, while he was reading it I was thinking of the lively time we had in Chicago recently with Drs. Bloodgood and Loeb, who were discussing the point of the validity of the term "precancerous." The term precancerous is being very much attacked by pathologists, but I think that is what it amounts to.

Dr. Fielding O. Lewis, Philadelphia, Pa.:

My experience is limited to six cases of laryngectomy, none performed long enough to determine a cure. As to the extrinsic involvements it would seem to me that the comfort these cases receive, though they may live only a few months or a year, is sufficient to repay them for what they suffer from the operation. I had a patient, a woman, aged fifty-eight years, with extrinsic involvement, and removed together with the larynx the upper part of the esophagus. The free end of the esophagus was then attached to the skin at the side of the neck. She has been quite comfortable, has gained twenty pounds in weight,

does home work for a large family, with no signs of recurrence, though it is only six months since the operation.

As to production of voice, I recall hearing a noted Irish surgeon, Sir Robert Woods, state that he taught his laryngectomy patients to produce sound by administering a few grains of citric acid followed by a few grains of bicarbonate of soda. A carbonic acid gas generated produces a sound as it escapes from the stomach through the esophagus. I have tried this method with fair success.

I am glad to hear of Dr. Mackenty's recent method of postoperative treatment, that is, leaving the lower part of the wound wide open. My cases are treated similar to tracheotomy patients. They are watched day and night by a nurse trained in tracheotomy cases and the dressings are changed as frequently as they become soiled, and as yet I have had no signs of infection of the external wound. Feeding through a Rehfuss tube, which is introduced into the duodenum as suggested by Dr. Beck, has been used in our cases. I should like to ask Dr. Mackenty if there has been any sloughing as a result of his anchor sutures?

Dr. Robert C. Lynch, New Orleans, La.:

I have had 52 cases, 17 cured, 14 living and the rest dead from other causes. The points in the technic of operation resembled Prof. Okada's in a way and in doing the dissection from below upward, and when we cut through the trachea we put in a large rubber tube, such as Dr. Mackenty used, which is sewed into the trachea at the time it is cut through. In that way we are able to protect the trachea from any entrance of blood, and then after a time, or at the time the wound is dressed, we use these block-tin tracheotomy tubes, made unusually large, so they would practically fit the trachea closely and beneath on a three-and-a-half-inch curve instead of two-and-a-half-inch curve because they lay straighter and more in the line of the trachea after excision. When the last six cases were done we used this tube instead of a tracheotomy tube, with a safety-pin put through the concave surface; we used this tube for a tracheotomy tube and allowed it to stick up above the wound about one and one-half inches, so that the trachea cannot soil the dressings in any way, and these cases have been very much more comfortable. We have used the gas-oxygen and ether anesthesia with perfect comfort to the patient. We did the operation not by a two-stage operation, such as Crile has described, in which the trachea was freed on its side and behind and packed with gauze and allowed to remain a week, but did a one-stage operation. We did preliminary tracheotomy in practically

all the cases subjected to laryngectomy and most of the cases will wear a tracheotomy tube six months to a year, and at the end of that time they can go without it. Most of them are sent away with two or three tubes of this type which they can boil and sterilize and finally, when the size is adjusted, we have a couple of silver tubes made of this type, which is much lighter and which they can clean thoroughly and keep themselves comfortable that way. We suture the esophagus with fine silk in two layers, the first layer catching up simply the mucous membrane, as was discovered in one of the cases in which it was necessary to remove two and a half inches of esophagus. Dr. Parham, in helping me, suggested we convert the esophagus into a tube by this one line of sutures into the mucous membrane, and in the desire to bring the raw surfaces into apposition, and, strange to say, with such little tissue as we had left, this helped, and as a lesson from that little fact we overlay the first line of sutures with a thin line of second sutures, and then we leave the rest of the wound practically open for observation, so that at the time of dressing of the case the wound is practically left wide open, so we can see the esophagus throughout its area of exposure, except the angle Dr. Mackenty called attention to. We make the T-incision that Dr. Mackenty described. We have found that during the preliminary portions of the operation up to the point of severance of the upper end of the larynx from the hypopharynx, that the patient is in much better position under suspended laryngoscopy, and that the mouth and the pharynx can be kept thoroughly clean with suction apparatus, and when we are ready to resect the trachea, even the epiglottis from the hypopharyngeal region, we can keep the mouth and upper end thoroughly clean under suspension and an assistant can watch the progress of dissection through the mouth while the operator works through the open wound. As soon as dissection is completed the patient is taken from suspension and suturing progresses with a perfectly clean mouth and hypopharynx. There are two of the cases which have developed speech which could be heard anywhere in this room—one is a doctor, who has returned to his practice of medicine, and no longer has any use for a pad or pencil; the other is a farmer, who has sent me about seven turkeys—each Thanksgiving Day he sends me a turkey as a remembrance of this operation. One of the lessons we have gathered from these cases is that one of the intrinsic cases which was prepared for operation on his entrance into the hospital, after going through all the preliminary examinations that we thought were necessary, developed some temperature, and in searching around for an additional cause for this

temperature we took a roentgen-ray picture of the chest and found a large metastasis in one lung. We were dealing apparently with an intrinsic carcinoma of the larynx, and yet this man had a metastasis in the lung which would have defeated the purpose of the laryngectomy. He was not operated on.

The second case which had an intrinsic growth of the larynx involving one vocal cord and fixing the arytenoid so it was immovable, was examined with the esophagoscope and found to have a lesion in the esophagus which would have defeated the purpose of the laryngectomy, and previous to that case we had done a laryngectomy on an intrinsic case, and six months after the laryngectomy the man complained of difficulty of swallowing and finally died of carcinoma of the esophagus, which apparently had no relation with the intrinisc tumor in the larynx. So all the cases are checked by the roentgen ray, and likewise an esophagoscope is used before operation is instituted.

In regard to Prof. Okada's selection of the type of operation to the case, I would like to say that there are three more cases of intrinsic cancer removed by dissection and suspension added to the nine reported to the American Laryngological Association in Boston a year ago, which are now after a year without recurrence or metastasis. That makes twelve cases altogether of that type. There is one point I should like to speak about in Dr. Jackson's paper: I have had under observation a man for three years who has what apparently was a keratosis localized to the central portion of one vocal cord, and he was kept under observation for nine months until I could hardly stand the strain any longer and admitted him to suspension for fear I was allowing him to progress with a carcinoma that should be operated on and under suspension. With a "fealer," as, we call it, or dissector, we could feel no induration and took out the central portion of this keratosis area, submitted it to a pathologist, cauterized the base from which we removed this small piece of tissue, and the pathologist reported it as, giving his description, if it were not cancer it would be before long. This man has remained under observation now for about a year and a half and he had no evidences further of the progress of this condition. On the contrary it seems to have narrowed down so that now the only discoverable differentiation from the normal is an area not much larger than the head of a pin, which is keratoid. Whether this represents a precancerous condition or whether this is simply an entirely separate lesion I cannot say.

Dr. Vilray P. Blair, St. Louis, Mo.:

You mentioned two cases that developed speech. Were either of

these esophagus cases, Dr. Lynch? The front of the esophagus, was it narrowed?

Dr. Lynch:

In one of the cases about one and a quarter inches of the anterior wall of the esophagus was cut down in a V and in all the cases the esophagus was closed, just as Dr. Mackenty closed, with the T through the center and under the hyoid. The other case that developed speech lost no appreciable anterior face of the esophageal wall.

Dr. Gordon B. New, Rochester, Minn.:

I should like to ask Dr. Lynch about the case that developed chest metastasis, whether the case had a cervical gland at the time?

Dr. Lynch:

No, there was no evidence. We concluded that the case was fit for laryngectomy because it was intrinsic carcinoma, which was too large to do by any other method with fixation of the cord and extension from the anterior commissure, and beginning to come back to the vocal process of the original fixation of the joint, and that man showed absolutely no other evidence of metastasis, either outside of the neck or any other way, and if he had not developed his temperature we certainly would have done a laryngectomy on him. I mention this because I have never seen it in print anywhere else, and it was an observation that frightened me about some of the intrinisc cases.

Dr. New:

I do not think that precancerous conditions of the larynx should be treated with radium, since in a certain group this will simply seal over the surface, and when the condition recurs as a malignant tumor it will be difficult to determine the extent of the lesion. I have seen many patients with laryngeal disease who have had radium treatment for what was apparently a precancerous condition, and after treatment with radium the condition had recurred as a very rapidly growing squamous-cell carcinoma.

We group patients who should have laryngectomy much the same as our Japanese guest does, taking care of the very early low-grade type of epithelioma of the cord by intraoral methods and performing thyrotomy when one cord alone is involved, without infiltration, and performing laryngectomies in the more extensive intrinsic cases. Some patients with a low-grade type of malignancy of the larynx, with

the cervical glands involved, stay well for many years after a block dissection of the neck and thyrotomy or laryngectomy.

Dr. Lynch's report of a case of epithelioma of the larynx with metastasis to the chest, without involvement of the cervical glands, is quite unusual. I have never seen a case of this type.

Dr. E. Ross Faulkner, New York City:

Dr. Mackenty has presented a notable record of his conclusions. He has followed the rational evolution of the surgery of carcinoma; I do not care where it is. The evolution of the surgery of the larynx has been, according to Dr. Mackenty, that conservative measures have to be given up for more radical measures. We would all like to evolve in another direction from radical to more conservative. I confess that my own ideas were very conservative in regard to this very thing. I followed Dr. Mackenty's work for many years, and I have come to the same conclusions that anyone else must come to after hearing his paper. There is always a stage where conservative measures might do. The difficulty is to find that. As a matter of fact I thought I might get as many cures in thyroidotomies as Dr. Mackenty, but I have never seen these cases. A case came to me where I thought it would be an ideal case for thyroidotomy. I opened the larynx, and quite at a loss to know what to do, I had the pathologist come in and make three frozen sections; they were every one malignant. I went ahead and did a laryngectomy, as it was the only thing to do. I remember another case in which I had an epithelioma to do, which I thought I would take out by thyroidotomy. That turned out to be tuberculous, although from the gross appearance anyone would have considered it a carcinoma.

Radium will probably help a great deal in saving cases that before were inoperable, but I do not think it will ever change the type of operation. I think the radical operation is usually the thing indicated when a diagnosis is made.

Dr. Jackson (closing):

I have been accused of opposing the operation of laryngectomy. In 1909 I reported 14 cases of laryngectomy. They are all dead now and the average duration of life was but little over a year. I felt that if laryngectomy could not show more than a year's duration of life after operation, in my hands at least, laryngectomy had, as Dr. Delavan has said, added nothing to the sum total of human life. A patient who is in fit condition to stand a major operation like laryngectomy will live for another year without our doing anything. Dr.

Jonathan Wright and our worthy President reported a case in a classical text-book in which a patient had lived for thirteen years without any operation whatever. The patient may be still living, I do not know, but the President is here and can tell us.

In regard to the selection of the procedure suitable to the particular case, as urged by Prof. Okada and emphasized by Dr. Delavan, to my mind this is one of the most important things. If we have a cancer limited to the tip of the epiglottis I think that adequate removal through the mouth can be accomplished, as was done many years ago by Dr. Delavan, with a cure of squamous-cell epithelioma, as I remember it. When, however, we have a growth on the vocal cord and can get the case when the growth is limited to the anterior two-thirds of the cord, I think the operation of choice is laryngofissure. I think distinction should be made between anterior and posterior intrinsic growths. I think that we should make a triple classification, namely, anterior intrinsic, posterior intrinsic, and extrinsic. If we have a growth approaching closely to the posterior portion of the cord, we have an exceedingly serious and usually fatal disease—a dire disease, as Sir Henry Butlin called it. The prognosis of posterior intrinsic cancer is nearly as bad as extrinsic cancer.

Recapitulating, if I had a malignant growth limited to the tip of the epiglottis, I should call on Prof. Okada, Dr. Mosher, Dr. Lynch, or Dr. Chamberlin to amputate the whole of my epiglottis. I should prefer not to be hung up on the gallows of suspension, but if they insisted I would submit. If I had an intrinsic growth limited to the anterior portion of one cord I would ask Dr. Ellen J. Patterson to do a laryngofissure with perichondral dissection and evisceration of that half of the larynx, and I should expect under these circumstances to go on for a good many years writing things that nobody ever reads. But if I had a cancer on the posterior end of the cord, and the arytenoid joint were still movable, I would ask that radium be applied under the supervision of Dr. Delavan. If the growth were extrinsic I should ask my friend Dr. Jonathan Wright, after invoking the spirit of Galen, to do the postmortem.

Dr. Mackenty (closing):

I want to thank Dr. Delavan for discussing in his usual classical way the paper which I read. His discussions are always valuable, and it seems that they are even more so today. As to the anatomical position of the trachea, it does not lend itself to posture drainage unless you turn the patient on his face. He spoke of personal care. This is extremely important. These cases require a tremendous

amount of personal care. The old thyrotomy of Butlin was a removal of the soft tissue only. It is a good thing that we got away from leaving the cartilage. Since we began to remove the cartilage (window resection) we have made a distinct advance over Butlin's original operation. I am glad Dr. Delavan does not believe in biopsy. In my statistics I had six or seven cases of thyrotomy. What I said was that in very few cases was thyrotomy indicated. As to the impression conveyed of my advocating euthanasia, I might believe in it for myself and might try to execute it on myself in advanced cancer, but not on anybody else. This patient I spoke of, perhaps a little too facetiously, had a very small chance of recovering on account of his septic condition, but we thought he had a small chance, and we gave it to him. He is now well after two years. If death had won, so desperate was his condition, some might have thought that we had committed euthanasia. I want to thank Dr. Beck for his support of my (as it may appear to many) very radical views on cancer of the larynx. No doubt, sometimes, laryngectomy is a safer operation than thyrotomy.

As to the anesthetic, I have assisted Dr. Arrowsmith in the operation done with rectal anesthesia. It was satisfactory in these cases, but I have seen rectal anesthesia in which the patient seemed to me in a dangerous condition. It is easy to give an overdose, and that is the trouble. Dr. Lynch's block-tin tracheal cannula must be very serviceable, but it cannot take the place of the conical bismuth gauze packing used around my tracheal cannula. The object of this conical packing is to prevent all secretion from entering the trachea, also to prevent tracheal secretion from contaminating the wound above. I regret that Dr. Lynch has not adopted the one-stage operation. It is so much more simple and the after-results so much more satisfactory. It has not been my good fortune to secure a great many primary unions under this operation, therefore, as the wound generally has to be reopened, I have adopted the plan of not sewing it up very securely. Where the teeth are entirely absent one may look often for a primary union. It is difficult to keep the mouth clean in the middle period of life on account of the condition of the gums. I am glad that Dr. Lynch feels as I do that radium is almost useless in cancer of the larynx. Dr. Jackson's facetious remarks on this occasion do very little to solve the problem. He evidently feels that a total laryngectomy could never be done on him; but why he should feel that all others having cancer should concur in this opinion, I do not know. I know many happy, useful citizens without larynxes. Perhaps if he were facing the question personally he might change his mind.

# CARCINOMA OF THE LARYNX AND ALLIED STATES TREATED LOCALLY WITH RADIUM EMANATION: A CLINICAL REPORT

OTTO T. FREER, M.D.

A YEAR ago, in the American Laryngological Association, I described a method for the treatment of laryngeal tumors with radium emanation. It was published with illustrations in the *Transactions* for 1921 and in the *Illinois Medical Journal* for August, 1921. Briefly it consisted of holding, by means of a long-jawed clamp fastened by a head band to the forehead, an emanation screen in the larynx by long applicators made of copper tubing for saliva suction, the applicator at its laryngeal end possessing a holder in which the silver screen containing the emanation tubes was fastened by means of wire. Since this description improvements have been made both in the clamp and applicators that need mention.

The 1921 clamp permitted only an up-and-down forward-and-backward motion of the screen in the larynx. The present clamp (Fig. 1), by means of a side-to-side cogwheel track, has also a lateral motion of three and three-sixteenths inches of the entire clamp to the right or left of the median line, permitting the clamp to meet the applicator stem exactly where needed without disturbing motions of the applicator in the throat from attempts to bring its stem opposite the open jaws of an immovable clamp, such motions leading to retching.

Formerly a number of applicators of different lengths was needed, each being a long, rigid copper tube bent at the laryngeal angle. At present only one applicator (Fig. 2) is needed, having the same angles as the old ones but possessing a socket and set-screw that permit attachment to it of varying lengths of the

final laryngeal bend of the applicator tube, so that only one applicator is needed for all depths of the larynx and for descent into the trachea.

The unchangeable rigidity of the older applicators was objectionable because the ascent and descent of the larynx in intolerant throats upon the stiff applicator during reflex retching led to friction and still further throat convulsions with strangling that made it necessary to immediately remove the applicator. The

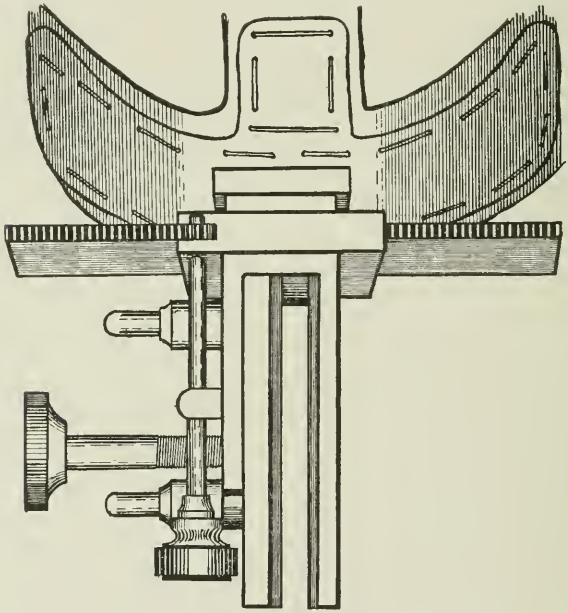

FIG. 1.—Improved head clamp to hold laryngeal applicator in larynx. It has a cogwheel track for lateral motion of the clamp.

present applicator is made to be stiff or elastic as desired by the cutting out of one and a half inches of the continuity of the copper tubing and supplanting it by a flat steel spring paralleled by a rubber tube slipped over the cut ends of the metal tubing to form part of the saliva suction tubing. To make the applicator rigid for introduction a metal rod is passed through the rubber tube

across the gap and into the further end of the severed metal tubing. When the screen has been placed in the larynx this rod

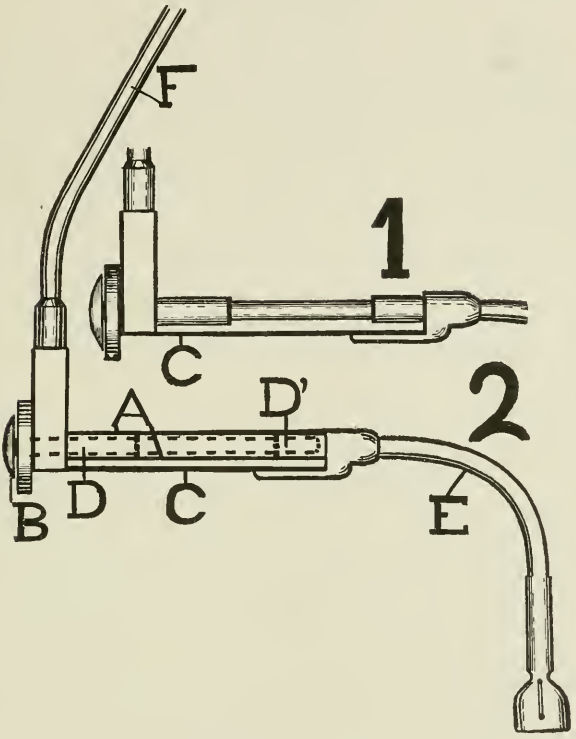


FIG. 2.—Improved elastic laryngeal applicator. 1, portion of applicator showing stiffening rod inserted across the gap in the tubing of the applicator to make it temporarily rigid for introduction of the screen into the larynx. *C*, spring. 2, the entire applicator with rubber suction tube *A*, connecting two severed ends of metallic tubing *D*, $D^1$, which, with the stiffening rod *B*, lie hidden inside of a rubber tube and are outlined by dotted lines. *C*, spring. *E*, short interchangeable copper tube screen-holder held in a socket in applicator by a set-screw, *F*, applicator stem cut off to save space in drawing. In its latest form the stem rests movably in its socket in the applicator, permitting the screen to be moved to either side. Fixation of the applicator on the stem is done by a set-screw.

is withdrawn and the spring comes into action, letting the screen rise and fall with motions of the larynx. The suction pump is

then attached and the saliva pumped away as with the other applicators.

## CASE HISTORIES.

Case I (November 21, 1919).—Man, aged seventy-five years, feeble. Has had carcinoma one and a half years, with gradually increasing pain in the throat radiating to the left ear, hoarseness and dysphagia. Can swallow liquids only. Examination: An extensive carcinoma involves the left aryepiglottic fold, arytenoid and cricoid regions. Treatment: Raying during a period of ninety-nine days, beginning November 21, in the larynx and the fossa piriformis; nineteen treatments; time used, eight hours forty-seven minutes; 390 millicurie hours in all. Only a single emanation tube used as applicator for more not yet devised. March 15, 1920: The tumor has disappeared from the throat. Reaction mild. Patient left for home state, where he died, May 5, from general causes. No report that growth had returned.

Case II (August 26, 1920).—Man, aged fifty-four years; duration of carcinoma, one and a half years. First noticed it externally as a lump in the carotid region. Patient swallows well and has no pain. Examination shows a carcinoma of the left aryepiglottic fold and fossa piriformis, which the tumor fills as a whitish mass. Stony-hard glands in the carotid region. Treatment during fifty-six days, beginning September 1; nine treatments; time of application, eight hours in all; total, 453 millicurie hours. October 26: All traces of tumor gone from throat. Under external treatments by Dr. F. E. Simpson the neck glands are much smaller. December 16: No return of the growth. A second series of prophylactic intralaryngeal rayings. Time, four hours and twenty-five minutes; 404 millicurie hours. April 21, 1921: No return in the larynx but the neck tumor is growing fast in the left supraclavicular region and has paralyzed the left recurrent laryngeal nerve. May 18: The neck growth reported growing deeply and uncontrolled. Patient died.

Case III (November 10, 1920).—Man, aged fifty-eight years; soreness of the left side of the throat, hoarseness and incessant tickling cough with shooting pains to the left ear. Symptoms began six months ago. Examination: The left arytenoid and aryepiglottic fold much swollen and bear a large slough. The epiglottis is turban-

shaped. There is a large gland tumor in the hyoid region. Treatments: Series 1, twenty days from November 12, 1920, 190 millicurie hours in the larynx and fossa piriformis; time used, two hours and thirty-one minutes. December 31: Larynx looks normal; cough gone; swallows perfectly. External tumor shrinks greatly after three external treatments. Second raying to maintain result: Twenty-one days from January 14; time, three hours and thirty-nine minutes; 382 millicurie hours; two treatments in the larynx and two in the fossa piriformis. April 20, 1921: Since February 25 the soft palate is red and sore and the epiglottis looks deformed, ragged and bleeds, the condition suggesting a superficial carcinosis of the rodent ulcer type. It is spreading and is very painful, with difficult swallowing. It looks like an unchecked spread of the cancer. The mass in the neck has begun to grow uncontrolled and has paralyzed the left hypoglossal nerve. Patient failed to return.

Case IV (December 25, 1921).—Man, aged sixty years. Slight hoarseness for a year with an uneasy feeling at the root of the tongue. The cords slightly reddened. The only abnormality of moment seen is a bean-sized nodule at the lowest point of the plica triangularis of the right tonsil. This was sectioned and proved to be a beginning carcinoma. Treatment: During a period of fifteen days, beginning December 27, 1921, 675 millicurie hours during six hours. Mild reaction: no return to date, April 29, 1922.

Case V (January 27, 1921).—Man, aged fifty-five years. Hoarseness with pain in the right side of the throat for a month. Examination: Voice a whisper. The entire right side of the larynx is immobile. No right cord to be seen. Its position overhung by a narrow ledge and an epiglottis bent and distorted by cicatricial contraction of a growth underneath it, of which only a small part is visible (Fig. 3). Little tumor formation. Diagnosis: Intrinsic, scirrhous carcinoma. Treatment: three series. Series 1, January 29, 1921, during twenty-one days, four treatments in the glottis; 388 millicurie hours; time, three and a half hours. March 1, voice has returned, clear and natural. The right cord has become visible and has slight motion. Series 2, two treatments, April 5 and 15; 214 millicurie hours. Voice strong; cord white but has only slight motion. No trace of growth (Fig. 4). Treatment prophylactic. December 29, 1921: The growth has returned. It has penetrated the base of the epiglottis forward

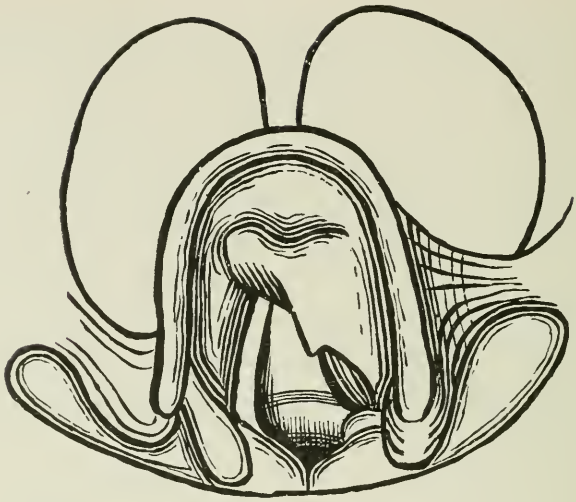

FIG. 3.—Case V. Scirrhous carcinoma when first seen.

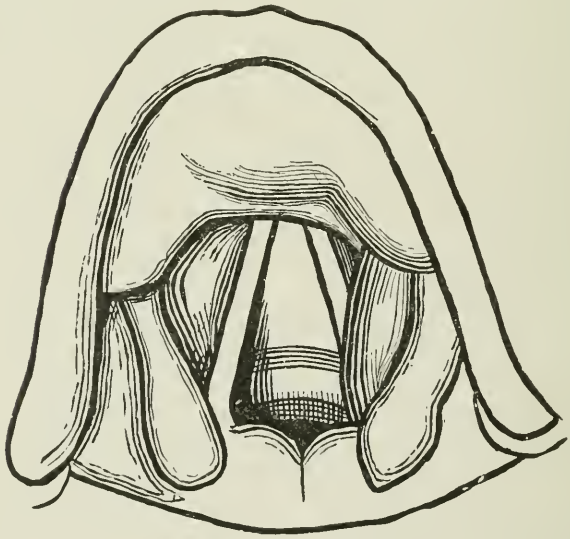

FIG. 4.—Case V. Reappearance of the cord and disappearance of the growth after raying.

and formed a large, smooth, rounded tumor at the base of the tongue, filling the glossoepiglottic region. It pushes the epiglottis backward. A mass has also formed in the right cord region, again hiding the cord. Third series of treatments—two treatments, January 6 and 20, 1922: A six-tube screen in an angular holder placed flatly upon the new tongue tumor, raying it from above. The same screen also used to ray forward from behind the epiglottis into the laryngeal interior, which has become too intolerant for contact raying. January 14: The voice has returned again but is weak. March 16: All trace of tumor at the base of the tongue gone. Glottis open enough for good breathing. March 25: The tumor mass in the right cord region smaller but still present. April 11, 1922: Patient died suddenly of heart failure.

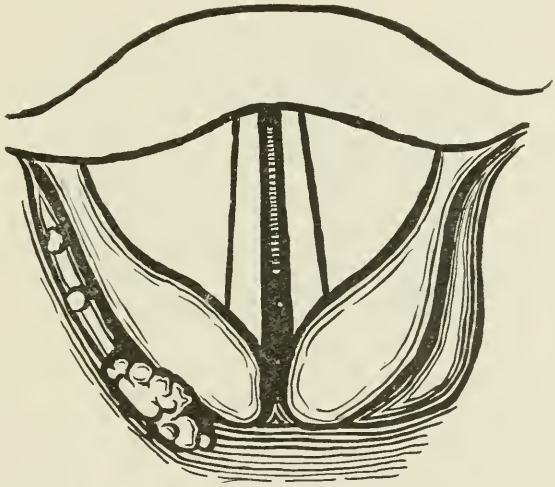

FIG. 5.—Case VI. Squamous-cell epithelioma overhanging the left arytenoid region.

CASE VI (April 8, 1921).—Man, aged sixty-one years. For a year the left side of the throat was sore, with pain shooting to the left ear. Examination: Small papillary carcinoma overhangs the left arytenoid body and aryepiglottic fold (Fig. 5). No gland enlargement. Treatment: First series in the left fossa piriformis from April 11, during two weeks; 328 millicurie hours; total time of application, two hours and forty minutes. April 25: All pain ceased, the growth no longer to be seen. June 24: The pain has returned and

a deep-seated mass projects from the depths of the left lateral pharyngeal wall with partly translucent edema of the left ventricular band and aryepiglottic fold. Second series. Three treatments in the fossa piriformis; 440 millicurie hours; time, three hours and nine minutes. Period of twenty-eight days from June 24 on. In spite of this raying the left cord became fixed and hiden by increasing edema and whitish opaque nodules appeared above the ventricular band Question whether the condition was due to radium reaction or to the uninfluenced progress of a deep-seated carcinoma coming to the surface. The opinion of the Mayo Clinic, consulted by the patient, was that the condition was a heavy reaction. Some hoarseness and inspiratory stridor because of the swelling. Great pain in swallowing. The white nodules mentioned finally developed into a tumor

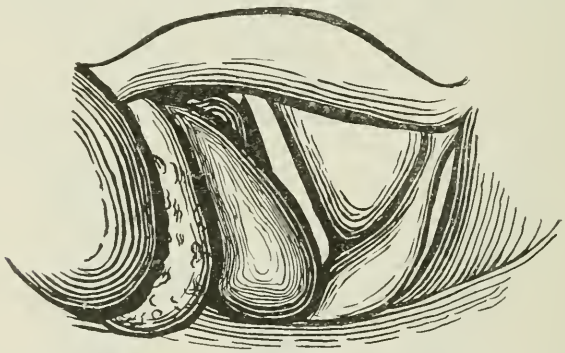

FIG. 6.—Case VI. Unchecked growth of the cancer in spite of raying.

of the size of a pecan, of a dead-white color (Fig. 6), and it became clear that the condition was not due to radium reaction but to the unchecked cancer. Third series—December 1 to January 1, 1922; 568 millicurie hours; time, three hours. This heavy raying had effect. The pain ceased and swallowing became easy. A foul, sloughing, cancerous mass cast itself out of the fossa piriformis and left it clean. The swelling is much less. The patient left for Florida after a final treatment of 207 millicurie hours on January 28. He writes that this last treatment caused great pain, but that it is leaving. April 6 the patient died. Not seen since January 28, so condition is unknown.

CASE VII (April 25, 1921).—Man, aged sixty-one years. Constantly hoarse since January, 1921. Examination: The anterior half

of the right cord shows an erosion upon a thickening of whitish hue surrounded by a halo of congestion (Fig. 7). The diagnosis of Dr. Norval Pierce and myself from inspection was carcinoma. This diagnosis was sustained by the rapid disappearance of the lesion under raying. Treatment: Period of thirteen days from May 7; 330 millicurie hours; screen placed in the glottis upon the growth. Time of application, two hours and twenty-four minutes. May 25: Lesion

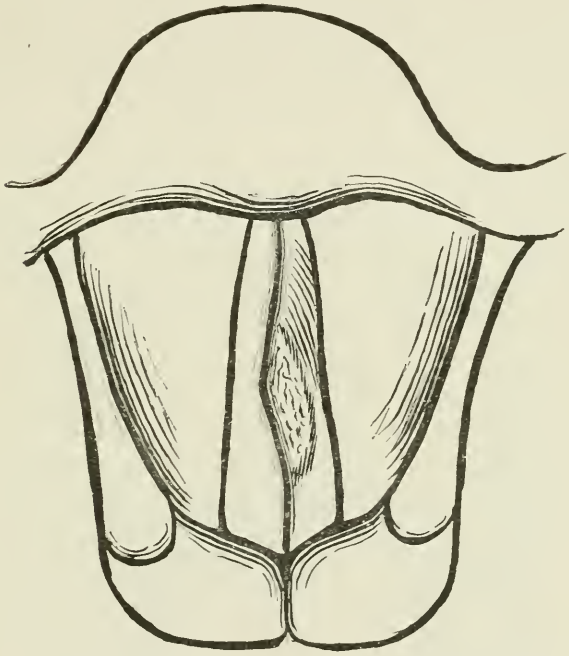

FIG. 7.—Case VII. Superficial beginning epithelioma. It disappeared entirely after raying.

vanished; cord looks normal. November 29: Patient seen with Dr. Norval Pierce. Except slight atrophy at the site of the lesion the right cord still looks normal. January 19, 1922: An erosion with a ragged edge has appeared on the border of the right cord, which has become red. No thickening or tumor. In spite of local treatment the erosion deepened. February 8: It was decided that the erosion was carcinoma—a rodent ulcer. To confirm the diagnosis and if possible arrest the process, Dr. Roy Flesher applied, February 9, a

heavy external treatment of emanation over the larynx upon the site of the erosion. February 24: The lesion healed in about ten days and the cord looks normal again, barring some congestion due to reaction. The action of the emanation through the larynx from without was absolutely selective upon the growth; no trace of reaction was seen elsewhere in the larynx.

Case VIII (May 2, 1921).—Man, aged seventy-two years. Hoarse since December, 1920. Pain radiating from the throat to the right side of the head and right ear. Cannot swallow solids; hence very weak from lack of food. Examination: Large carcinoma of the right cord, which is fixed. Epiglottis strongly drawn backward and to the right by the retracting growth, which is of the schirrous type of carcinoma. Treatment: Patient's weakness limits treatment. May 4 to May 11, 153 millicurie hours; time, one hour and thirty-five minutes. Only small screens could be used as the glottis was obstructed by the growth. May 14: Swallowing and breathing both better. Went to his home town. Died May 5 from weakness.

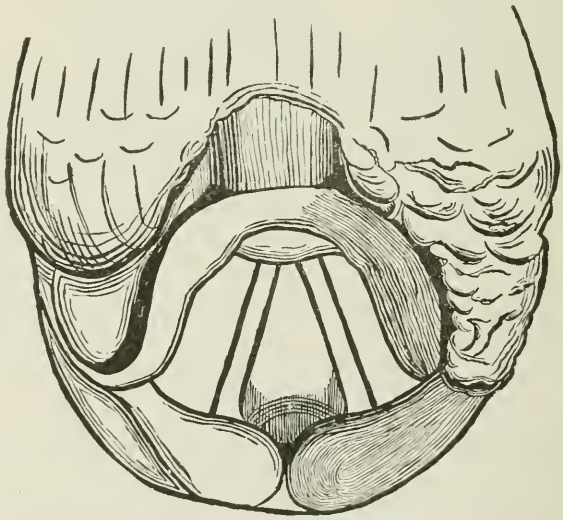

Fig. 8.—Case IX. Carcinoma of the base of the tongue and epiglottis with a large external package of cancerous glands.

Case IX (May 24, 1921).—Man, aged sixty-eight years. Since three months has had intermittent darting pain in the right cheek

bone, ear and face. Examination shows a large deep-seated nodular growth filling the right vallecula, reaching forward into the base of the tongue and backward into the swollen epiglottis (Fig. 8). Package of hard, nearly fixed glands, the size of a small apple, behind the right angle of the jaw. Treatment: Period of twenty-four days from May 26; 488 millicurie hours in the fossa piriformis and upon the base of the tongue. Time, three hours and fifty minutes. Two later treatments, July 27 and 30; 210 millicurie hours in all; 696 millicurie hours besides several heavy outside treatments over the glands. . July 25: All traces of the carcinoma gone both in the throat and in the neck (Fig. 9). September 2: A hard nodule appeared behind the right ramus of the jaw. It disappeared after

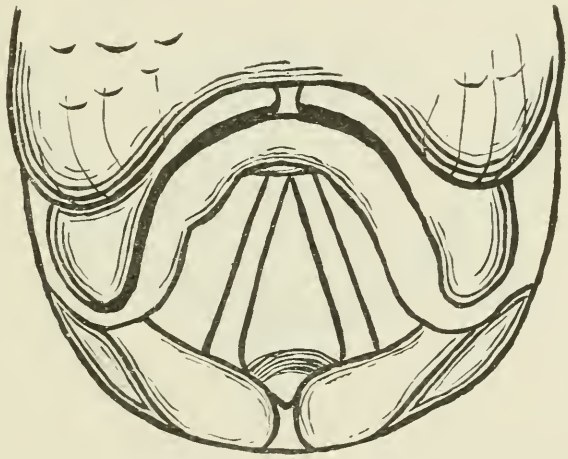

Fig. 9.—Case IX. Disappearance of cancer in the neck and the throat after twenty-four days since beginning of the raying.

external treatments. No return of growth in the throat. A prophylactic treatment of 178 millicurie hours given nevertheless in the throat over the pharyngoepiglottic fold to cross-ray with the external treatments. January, 1922: Dr. Carr, of Minot, N. D., wites that there has been no return of the tumor but that the patient has a serious cerebral ailment.

Case X (May 24, 1921).—Man, aged sixty-six years. Very advanced case; patient exhausted. Three months ago had a very sore throat with shooting pains to the ears and to the head since.

Can hardly swallow now. Lives on liquids. Examination shows a very large, soft, lobed tumor of the posterior pharyngeal wall below the level of the tip of the epiglottis. It fills the laryngopharynx and directs food and drink into the larynx while excluding it from the esophagus. It is not possible to pass a bougie into the esophagus. Treatment: Two treatments, May 24 and June 7; 320 millicurie hours; time, one hour and twenty-five minutes. The growth receded one-half in a week and swallowing improved, but the patient was too weak to survive.

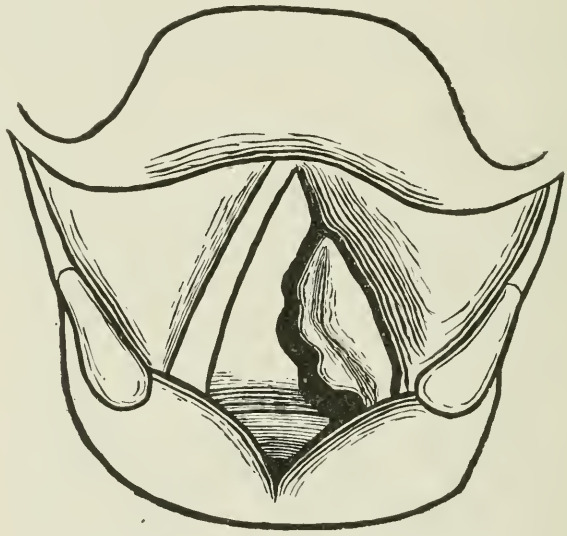

FIG. 10.—Case XI. Sarcoma of the right cord.

CASE XI (May 25, 1921).—Woman, aged forty-two years. Hoarse for three months; voiceless for the last three weeks. Referred by Dr. George Dennis. Examination: A soft, lobed, smooth tumor replaces the posterior two-thirds of the right cord (Fig. 10). No cord to be seen but motions of the larynx perfect. Diagnosis: Sarcoma. Dr. Dennis found the growth of the tumor alarmingly rapid. Treatments: Three treatments in a period of thirty days from June 8; 290 millicurie hours; screen upon the tumor; time, two and a quarter hours. June 29: Tumor vanished; right cord has come to view; laryngeal interior looks normal (Fig. 11). Voice perfect. December 19: A slow return of the growth in the old place. December 21: 128 millicurie hours in the glottis. January 17: 140 millicurie hours

in the right fossa piriformis; total, 268 millicurie hours. January 9: Growth gone again; cords look normal. February 18: A prolonged but mild reaction has kept the throat sore and the arytenoids swollen, so that the patient can only whisper, as the cords cannot come together. March 18: Voice still a whisper but the arytenoid swelling is subsiding. It is the only expression of a long reaction. April 10: Voice returning; swelling leaving. April 20: The voicelessness now functional aphonia. Natural voice returns during interrupted external galvanism; cords normal.

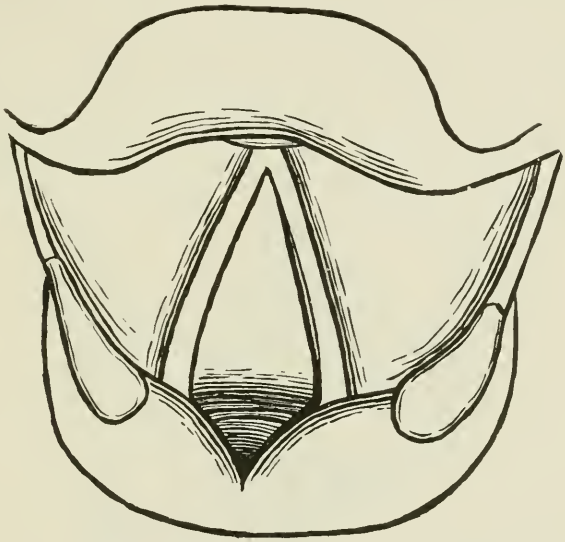

FIG. 11.—Case XI. Disappearance of the growth after thirty days.

CASE XII (June 20, 1921).—Man, aged forty-five years. January 4, 1921, Dr. Norval Pierce removed the anterior half of the cricoid ring and part of the trachea below it to remove a carcinoma of the left vocal cord. June 5: The carcinoma returning the patient was referred to me for emanation raying. June 20: Examination. A smooth swelling on the left side of the larynx in the place of the left vocal cord greatly narrows the glottis. The right cord is visible. August 1: Treatment delayed by a large neck abscess reaching from the upper border of the thyroid cartilage to the sternum. Larynx closed by swelling. Dr. Theobald, representing Dr. Pierce, inserted

a tracheotomy tube into the defect in the cricoid cartilage left by the operation. Four intralaryngeal emanation treatments from above from August 1 to 20, 306 millicurie hours; had no effect because the screen was constantly expelled by violent coughing. Looking upward from the defect in the cricoid ring the larynx was seen to be completely filled with a tumor mass. Shown to be carcinoma by the microscope. An ovoid three-tube capsular screen inserted through the tumor substance from below into the larynx. Three treatments were given with this screen, 479 millicurie hours in all, during eleven days from September 9 to September 27. The larynx is now cleared of the growth; the patient breathes freely through it and can speak in a fair voice. October 18: The larynx is filling up with a tough, white, radium exudate that has again closed its lumen; tube reintroduced. November 1: Cancerous outgrowths are forming around the laryngeal fistula and the front of the neck has become deeply infiltrated with cancer, showing extreme malignancy. An ulcer on the posterior wall of the trachea is destroying the anterior esophageal wall. The patient left my care. Died January 1, 1922.

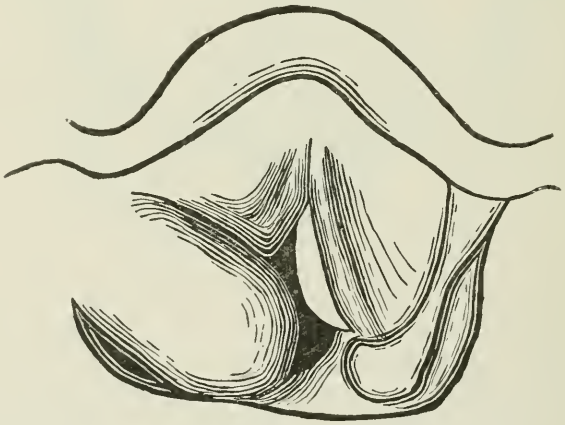

Fig. 12.—Case XIII. Advanced cancer obstruction of the larynx.

Case XIII (June 2, 1921).—Man, aged seventy-one years. Increasing obstruction to breathing and hoarseness for a year. Referred by Dr. Samuel Salinger for treatment of laryngeal carcinoma. Advanced case. Examination: Left arytenoid, aryepiglottic fold and ventricular band fused in a great immobile mass (Fig. 12). The right cord is replaced by an ovoid white tumor projecting from a diffuse thickening

of the tissues. No external tumor. Previously to raying a low tracheotomy was done by Dr. Salinger. Treatments: July 1 to 19, three treatments; 436 millicurie hours; time, two hours and fifty-five minutes. September 10: Growth disappeared. The ventricular bands, cords and aryepiglottic folds have become merely loose, curtain-like folds of the mucous membrane, the neoplasm and edema that filled out these structures having been absorbed. No trace of cord structure (Fig. 13). February 19, 1922: The white tumor has returned; breathing has again become stenotic and the growth is starting up again, where it may be seen as a whitish mass on the left side of the larynx in

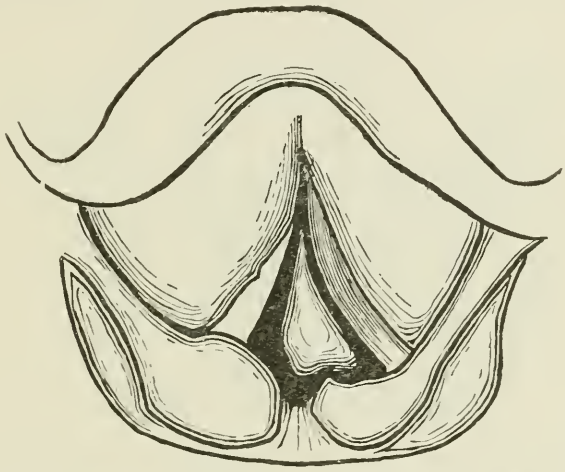

FIG. 13.—Case XIII. Cancerous tissue gone but the larynx left deformed by the growth.

the subglottic region. March 16: 202 millicurie hours; time, forty minutes. March 12: 220 millicurie hours; time, fifty-four minutes. Long applicator tube used to reach into the subglottic region. March 27: Complains of marked pain in swallowing. No reaction to be seen as yet. April 4: All trace of growth gone again. Larynx well open. No reaction. April 27, 1922: No return.

CASE XIV (June 27, 1921).—Man, aged seventy years. Examination: Left side of the larynx motionless; right side movable. All features of the larynx merged in a diffuse, convoluted mass, leaving a small opening for breathing, so that there was considerable dyspnea.

No trace of cords (Fig. 14). Enlarged glands in the left carotid region. There is an ulcer where the right cord should be. Diagnosis: Scirrhous type of laryngeal cancer. Advanced case. Treatments: Two external treatments applied to open the larynx enough, if possible, for internal raying. July 2: Small screen, because of narrow lumen, with 63 millicurie hours, placed in the glottis region. July 12: Radium reaction has narrowed the laryngeal lumen so that a low tracheotomy was done. July 26 to August 8: 443 millicurie hours; screen placed from above in the glottis. Time, three hours. August 9: Carcinoma disappeared. There is now a clear view down the trachea. November 4: Larynx wide open. Cords seen as white, immobile

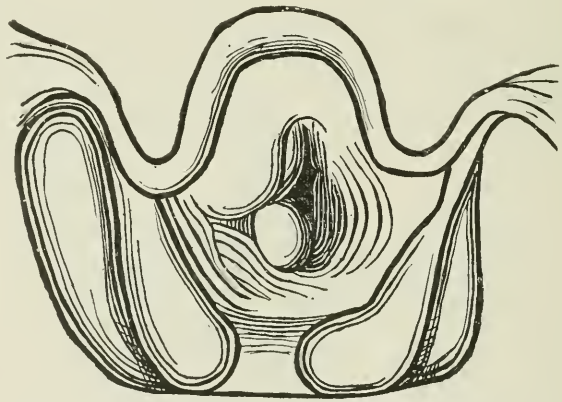

FIG. 14.—Case XIV. Advanced obstructive carcinoma of the larynx, schirrous type with cicatricial deformities.

bands cicatricially fixed; no tumor (Fig. 15). December 6: Recurrence. Patient returns with marked laryngeal stenosis. From the glottis down for three rings of the trachea a mound of white, tough, foul-smelling exudate is seen firmly attached to the posterior laryngeal and tracheal wall filling all but the anterior one-third of the laryngeal lumen. The exudate had to be cut away with a laryngeal punch to partly clear away the obstruction to breathing. The arytenoids were enormously swollen, with great pain. The condition is a return of the carcinoma in a place adjoining the first site. As the case was an advanced one when first seen this relapse made the prognosis seem hopeless. Treatment: December 8, 1921, to January 13, 1922: 628 millicurie hours, the screen lying upon the exudate from its lowest

point in the trachea up. Patient had several weeks of constant pain with slow disappearance of the exudate. Finally, January 31, pain and exudate gone. The larynx free from swelling and all trace of disease. Returns home in vigorous health. April 1: Examination shows the larynx and trachea free from cancer. Patient in perfect health.

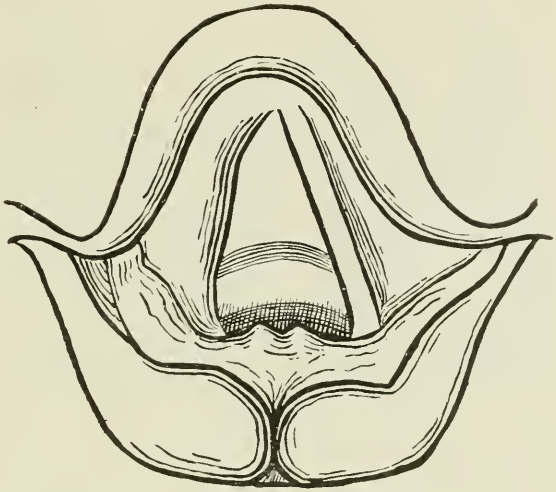

FIG. 15.—Case XIV. Disappearance of the cancer after raying. Cords seen as white immobile bands, cicatricially fixed.

CASE XV (July 15, 1921).—Man, aged seventy-five years. An advanced case. A large carcinoma of the left half of the larynx demanded immediate tracheotomy. Some external treatments were given but the patient was too weak for internal raying. Died soon of exhaustion. Example of moribund type often sent in.

CASE XVI (August 11, 1921).—Man, aged seventy-six years. Another very advanced case. An immense carcinoma of the epiglottis hid the larynx and interfered with breathing. Enough was removed by Dr. Munns to permit breathing and swallowing. 200 millicurie hours of emanation were used in the throat with marked improvement in swallowing after reaction was gone. The patient failed to return.

CASE XVII (August 23, 1921).—Man, aged fifty-nine years. Right fossa piriformis filled by carcinoma. Much edema of the right

arytenoid region. Gland, the size of a hickory-nut, behind the angle of the jaw (Fig. 16). Treatment, August 23 to September 10; time, three hours and ten minutes; 442 millicurie hours; screen in the fossa piriformis. September 10: All trace of growth gone (Fig. 17). Gland

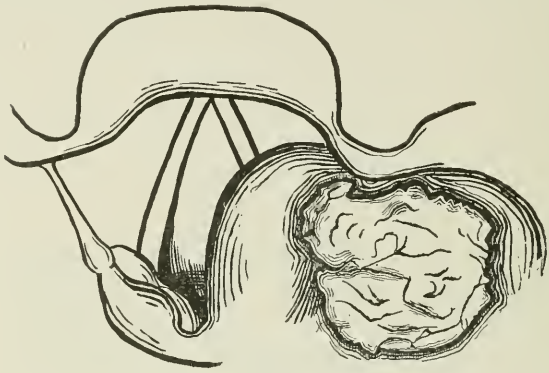

FIG. 16.—Case XVII. Cancer of the right fossa piriformis.

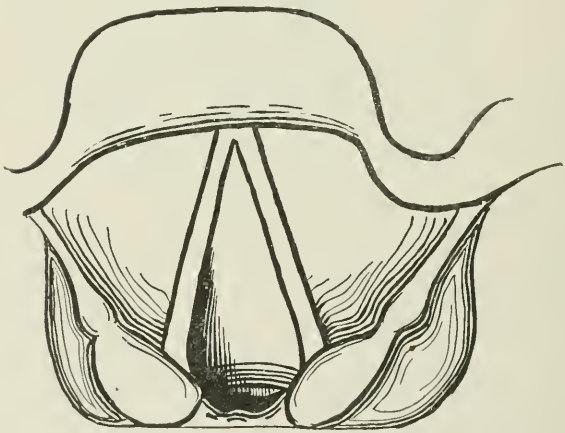

FIG. 17.—Case XVII. Disappearance of the cancer after intralaryngeal raying. Larynx still clear to date, May 28, 1922. Small, hard gland in the neck being rayed.

disappeared after external raying. January 18, 1922: Throat stays normal; no enlarged glands. Prophylactic treatment of 179 millicurie hours. Slight reaction. March 28: Throat normal. No recurrence.

Case XVIII (August 27, 1921).—Man, aged fifty-six years, referred by Dr. G. W. Boot. Six months ago he developed cancerous glands on the left side of his neck. These glands were excised by Dr. Boot

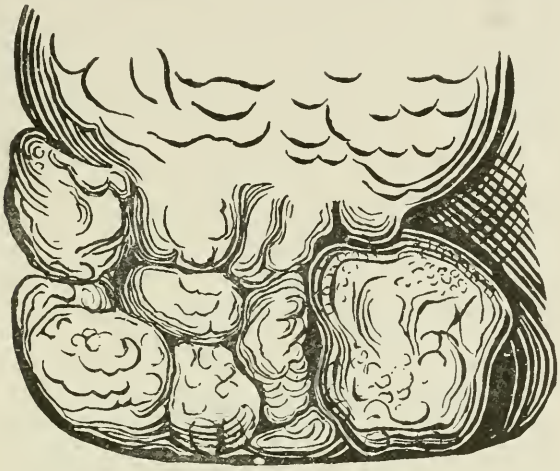

Fig. 18.—Case XVIII. Very large, soft cancer filling the pharynx and the laryngeal entrance.

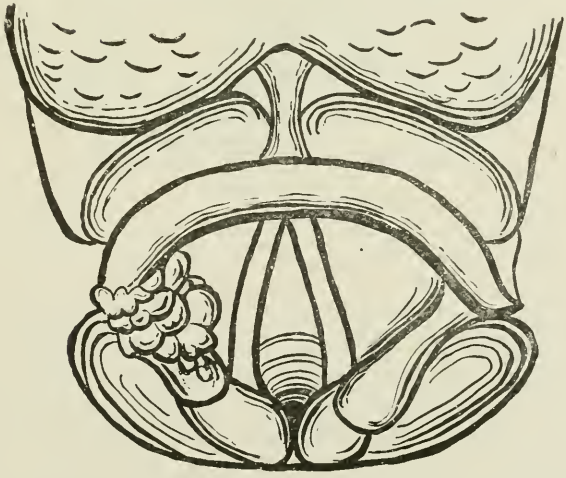

Fig. 19.—Case XVIII. Disappearance of all but a small remnant of cancer It yielded to later raying. No return in the throat. Patient died of cerebral metastasis.

and carcinoma was microscopically found in them. Patient swallows with difficulty and has constant pain in the right upper arm and shoulder. Examination: A huge cancerous mass fills up the pharynx from the base of the tongue to the posterior pharyngeal wall (Fig. 18). Treatment: August 30 to September 6; 473 millicurie hours; time, three hours and twenty minutes. Screen thrust into the soft growth. October 8: All of growth but a bean-sized remnant upon the left half of the epiglottis has disappeared, leaving a normal appearance of the parts (Fig. 19). Swallowing and breathing now perfect. November 8: The remnant grew and occupied the left tonsil and arytenoid region. Pain in the arm intense. November 11 to 18, 375 millicurie hours. December 3: All of the tumor now gone from the throat. The pain in the left humerus shown to be due to a metastasis in the medullary canal of the humerus. February 10: Information received that the patient died of a cerebral metastasis.

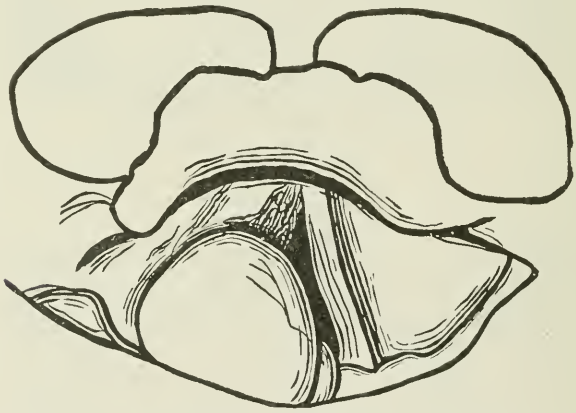

FIG. 20.—Case XIX. Globular hypertrophy masking deep-seated cancer. Squamous-cell epithelioma. Very refractory to radium.

CASE XIX (September, 1921).—Man, aged fifty-nine years. Hoarseness for ten months. In the last three weeks can only whisper. Examination: A globular, semitranslucent outgrowth occupies the entrance of the larynx, hiding its interior (Fig. 20). The outgrowth rests on a diffuse hypertrophic swelling of the left half of the larynx. Both sides of the larynx immobile. No enlarged glands. Breathing somewhat obstructed. Two external radium treatments given in the hope of shrinking the obstructing outgrowth and opening the

larynx better, but they had no effect, and on September 28 the globular mass had to be removed with the Heryng-Krause double curettes, as it threatened suffocation. This left the larynx well open and breathing easy (Fig. 21). Histologic examination of the mass by Dr. Ludvig Hektoen showed merely pachydermia with fibrous hypertrophy. Dr. Hektoen, however, as later proved to be correct, suspected a cancer deep in the laryngeal tissues. Treatment: October 7 to 15; 407 millicurie hours applied in the laryngeal lumen from

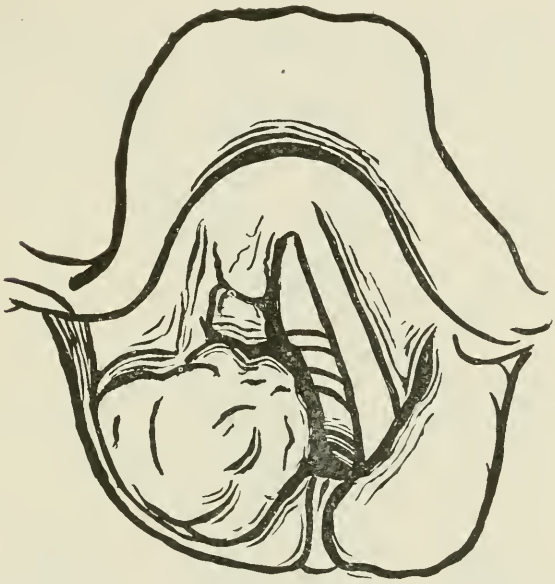

Fig. 21.—Case XIX. Interior of the larynx seen after removal of the globular mass.

the subglottic region up. No improvement; severe reaction with painful swelling. By December 2 the larynx had again filled up with hypertrophic masses and breathing so obstructed that a low tracheotomy had to be done. Pieces excised from the larynx this time showed a typical squamous-cell epithelioma with many perles and keratotic masses. January 23 applied 305 millicurie hours in one treatment of one hour and twenty minutes. Severe reaction again, the carcinomatous lining of the larynx becoming deeply infiltrated with a thick, white opaque membrane which I have found typical

of severe reactions in the larynx. Swallowing very painful and only liquids could be taken. There was a gradual casting off of the membrane with declining reaction, so that by February 18 swallowing was much better and the larynx well open. The prospects of benefit from the raying seemed better, when the patient died of lobar pneumonia.

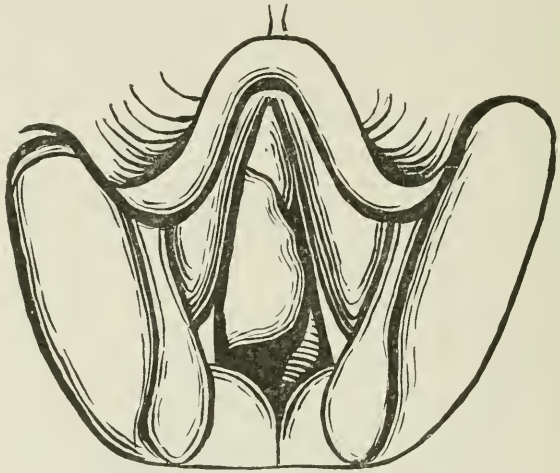

FIG. 22.—Case XX. Carcinoma of the larynx. Quite refractory but yielded finally to raying.

FIG. 23.—Case XX. After four weeks of raying the growth was gone, all but a small anterior nodule.

CASE XX (September 14, 1921).—Man, aged sixty years. Referred by Dr. Fischbach, of Cincinnati. Sections from a small nodular growth in the anterior commissure of the cords removed by Dr. Fischbach showed carcinoma. A radiologist gave a treatment of 50

mg. of radium, the patient himself holding the screen "somewhere in the throat," so that it obviously did not get into the glottis, where the growth was. Examination, September 14: Patient nearly voiceless. A smooth, bulging, lobed tumor takes the place of the right cord, whose substance it has buried (Fig. 22). Treatment: September 30; 481 millicurie hours. October 26: The tumor gone from the posterior two-thirds of the right cord, which has emerged in normal form (Fig. 23). A small nodule of the growth still projects from the anterior third of the cord, its later disappearance being hoped for. February 13, 1922: A recurrence has appeared along the right cord as a ledge attached to and blending with the under surface of the cord. Applied 260 millicurie hours in one hour. February 27: The ledge has disappeared. March 22: No tumor seen but the cord is deformed into a broad shelf. Its motions are good. Voice still rough. Period of reaction still in progress, so that improvement may still take place.

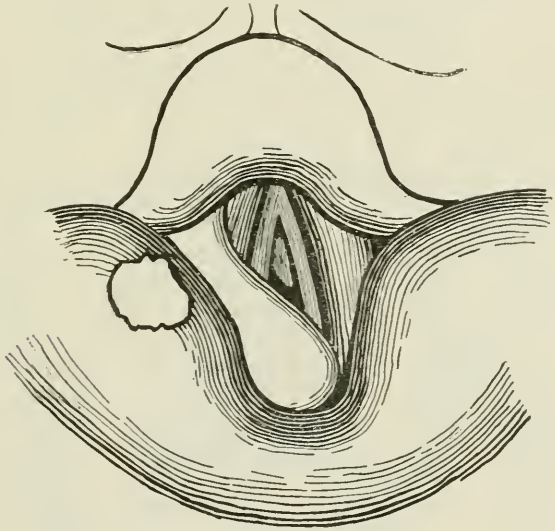

FIG. 24.—Case XXI. Shows an intense radium reaction, gone after four weeks.

CASE XXI (September 16, 1921).—Man, aged fifty-two years. Carcinoma for three months; has hoarseness, painful swallowing and coughs when he swallows food. Examination: A cancer involves the left arytenoid region and encroaches upon the left ventricular band; cord movable. Treatment: 401 millicurie hours in two treat-

ments, September 16 and 26. Only ten days after the first treatment the growth had all disappeared, the larynx looking normal. October 19: A very strong radium reaction with swelling of the posterior pharyngeal wall. Swallowing hardly possible (Fig. 24). November 3: Reaction leaving; swallows well again. February 6, 1922: Well until November 17, then he states that his neck began to swell, and two weeks ago it suddenly enlarged enormously on the left side. Can hardly swallow. Examination: A foul, ulcerating tumor reaches from the tonsil down into the left fossa piriformis and a great elastically soft, pink growth as large as a man's fist projects from underneath the left sternomastoid muscle. Patient very weak. February 9: 220 millicurie hours applied to the ulcer together with an outside treatment by Dr. Flesher to the neck tumor. February 25: The neck tumor formed a great abscess which burst externally and into the throat. Patient in care of a general surgeon. Died of exhaustion and sepsis.

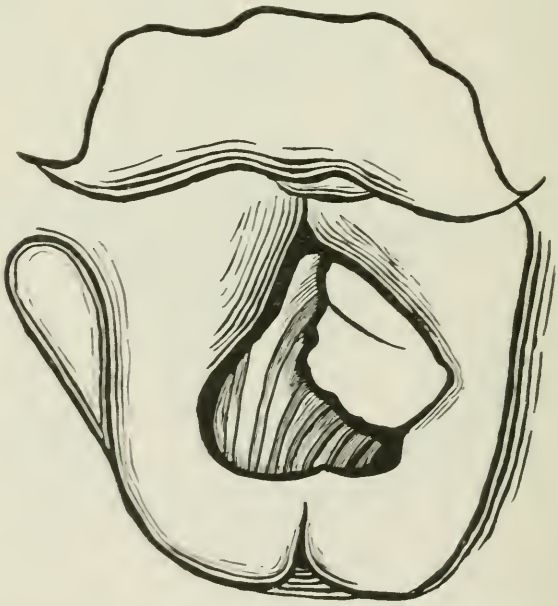

FIG. 25.—Case XXII. Cancer hiding the right cord.

CASE XXII (October 5, 1921).—Man, aged seventy-two years. Carcinoma of the right cord with both ventricular bands invaded. Advanced case. The right cord hidden by the growth in which it

FIG. 25a.—Case XXII. Larynx-chorea dead by exsection and suicide. After [illegible]

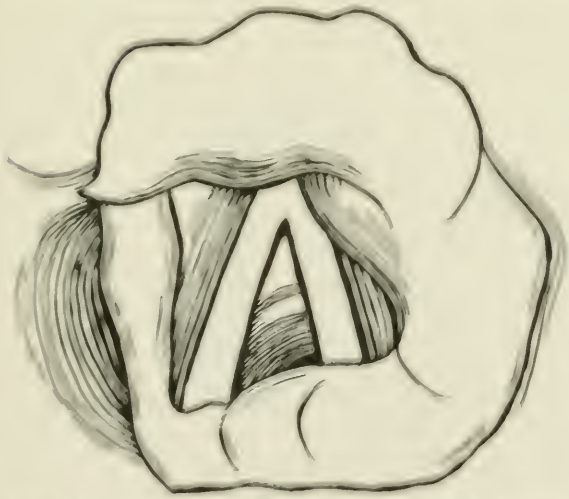

FIG. 26.—Case XXII. Growth and edema gone. Cords fresh normal. Colon returned. Head of tongue three months later.

is imbedded. Right side of the larynx immobile. The laryngeal entrance is edematous. Treatment: October 12 to November 9; four treatments; 484 millicurie hours in the glottis and the fossa piriformis. Reaction early in three days with general edema of the larynx; at its worst November 14 (Fig. 25). December 28: The tumor has vanished and both cords have come to view, looking normal (Fig. 26). The right cord is movable again. Voice clear; swelling gone. Externally a hard infiltration in the thyrohyoid region on the right side, which appeared December 7, is gone. January 18, 1922: The growth has returned in the larynx and the hard infiltration mentioned has become deep and extensive, taking in all of the tissues from the skin through the larynx to the cord. It is this cancerous infiltration of the neck structures that has reinvaded the cord region from without. Had it not existed the laryngeal interior would probably have stayed well. January 21: 246 millicurie hours in the right fossa piriformis. February 8: Edema of the larynx, gradually increasing, made a tracheotomy necessary. Dr. Bressler operator. The cord became visible again but the neck infiltration was formidable. The tracheal tube traverses it. March 27: Patient very weak but growth stationary. Died April 4.

Case XXIII (October 21).—Man, aged fifty years. For the last six months has had vague and alarming sensations in the larynx. The patient was referred by Dr. W. H. Folsom, who found a ragged little ulcer upon the right processus vocalis and suspected carcinoma. Examination shows the inner surface of the right processus vocalis rough with ragged projections and eroded places. No swelling. Cord mobile. Diagnosis: Beginning epithelioma. Treatments: October 22 to 28; 418 millicurie hours; four treatments in the glottis and right fossa piriformis. November 4: Processus vocalis now smooth and disagreeable sensations gone. January 1: Dr. Folsom writes that the larynx stays normal. No report since.

Case XXIV (November 12, 1921).—Woman, aged forty-six years. Hoarse since 1920. In the spring of 1921 hoarseness was greatly increased and by August she was voiceless. Pain appeared, shooting to the right ear. Examination: Right cord invisible; only the ventricular band, lifted by a growth underneath it, seen. The left cord was visible and mobile. Right half of the larynx fixed (Fig. 27). A hard gland felt in the right carotid region. Diagnosis: Extensive and deep invasion of the larynx by a scirrhous retracting type of

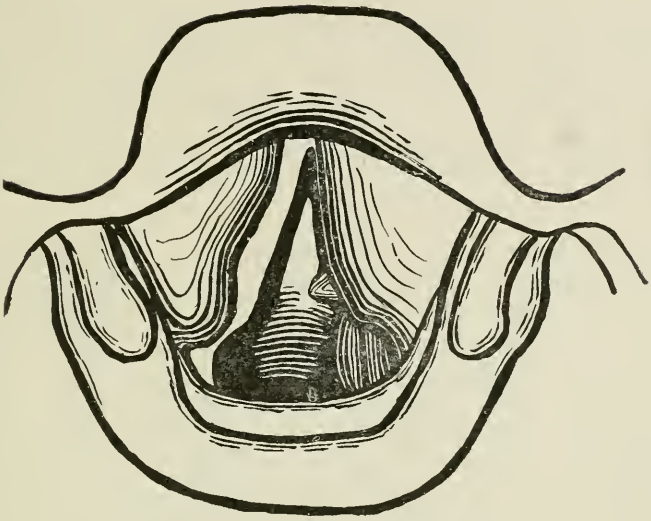

FIG. 27.—Case XXIV. Deep-seated schirrous carcinoma of two years' standing. Fixation of right cord, which is buried in the tumor.

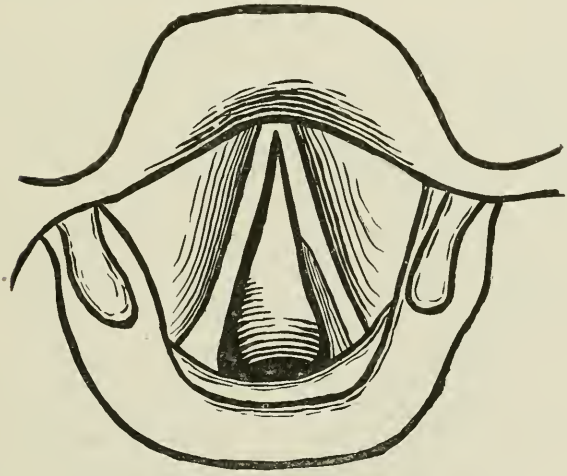

FIG. 28.—Case XXIV. Cords reappeared. Right cord now mobile. Voice clear and strong. No return.

carcinoma. Tumor formation minimal. Treatment: November 16 to December 20; 471 millicurie hours; three treatments. January 5, 1922: Right cord has come to view. Both cords look normal and move normally. Voice returning. February 17: Appearance of larynx natural. March 16, 1922: Voice loud and clear with a slight roughness when it is forced. No recurrence. This patient had been condemned to a laryngectomy.

Case XXV (January 28, 1922).—Man, aged sixty-four years. Hoarse for six weeks. Examination shows a deeply infiltrating, dead white growth with a fuzzy surface upon the anterior half of the left cord. The growth is inset in the cord substance, which is deeply swollen and inflamed. Cord mobility but little impaired. Treatment: January 5 to February 3; 410 millicurie hours in fossa piriformis and glottis. Time, two hours. Screen had to be often replaced. Irritable larynx with constant retching. March 6: Voice now perfect, cleared in a few days. Swelling and inflammation of the cord gone, but white patch still seen upon the anterior one-third of the cord, the only sign of the carcinoma remaining. March 17: 202 millicurie hours, all in the glottis upon the white patch. March 27: The white fuzz going away but the exudate upon the cord is still dull white in color. April 17: White patch diminishing but not gone.

Case XXVI (January 19, 1922).—Man, aged fifty-two years. Since December 3, hoarseness and pain in swallowing. Nocturnal pain in the throat. Occasional spitting up of a little blood from the throat. Examination: Retraction of the floor of the left fossa piriformis leaving a deep hollow at its bottom. The only tumor formation seen was a small growth at the base of the left arytenoid body. Left cord immobile but looks normal. No ulceration. Diagnosis: Deep-seated retracting scirrhous form of carcinoma. Treatment: January 24 and February 2, 1922: $452\frac{1}{2}$ millicurie hours in the left fossa piriformis and in the glottis; screen nearly in contact with the left cord, for the throat is too irritable for actual contact. January 30: Voice clear and loud. February 6: Less discomfort in swallowing. March 4: A mild but lasting radium reaction for the last four weeks. Patient says that he cannot swallow solids but no obstruction was found on inspecting the laryngopharynx or passing a bougie down the esophagus. Condition seems autosuggestion. The cord is still immobile. Strong external treatments by Dr. Flesher over the site of the fossa piriformis, March 4, 7 and 10. March 18: Can swallow toast now. Cord still fixed. April 1: Patient gave up treatment and ceased to report.

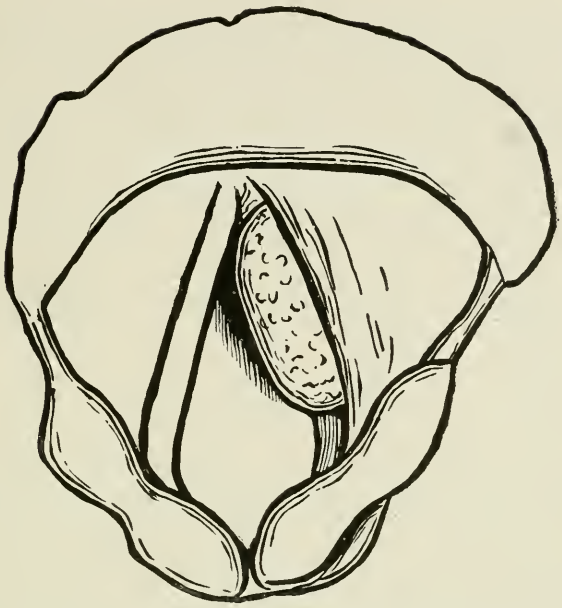

FIG. 29.—Case XXVII. Cancer of the right cord.

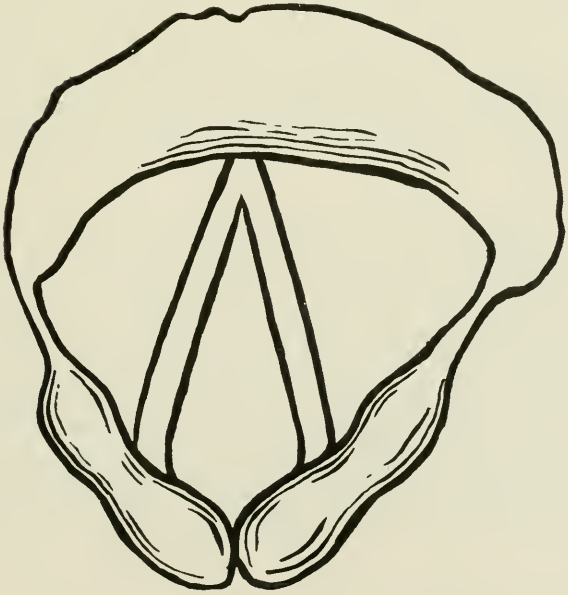

FIG. 30.—Case XXVII. Tumor gone after raying.

Case XXVII (February 2, 1922).—Man, aged fifty-five years. Hoarse since December 15. No cough or pain. Examination: A long, bulging, white growth (Fig. 29) takes the place of the right cord and has imbedded it completely. Both sides of the larynx move normally. Diagnosis: Carcinoma. Treatments: February 8 and 15; 460 millicurie hours in one and a half hours; screen in the glottis upon the growth except fifteen minutes in the right fossa piriformis. February 15: Complete disappearance of the tumor. Cord reappeared. Voice normal (Fig. 30). March 6: There was a normal reaction; cords red; thick white exudate over the site of the growth. Return of hoarseness. Today reaction is gone; voice normal again; appearance of larynx normal.

## ASSOCIATED CONDITIONS

Case I (Malignant Nasal Case. January 23, 1920).—Man, aged sixty-two years. The right lower turbinated body was destroyed by a round-cell sarcoma. The middle turbinate and ethmoid cells were invaded. 339 millicurie hours of emanation placed in naris with three single-tube screens attached to the thick copper wires held in the small forehead clamps, so that the screen lay just where it was desired. Previous to raying there was a surgical removal of a visible part of the growth. Complete recovery. No return so far after two years and two months.

Case II (Papilloma of the Right Cord. April 4, 1921).—Woman, aged twenty-six years. The papilloma covers the entire right cord. Treatment: 162 millicurie hours in the glottis. Growth gone by June. No return so far, April 27, 1922.

Case III (June 29, 1921).—Possibly malignant growth of the right cord. Aspect that of an angiofibroma intimately entering into the right cord (Fig. 31). Internal raying impossible at this time on account of excessively sensitive throat and slight effect of cocain. External treatments given by Dr. Flesher therefore substituted. July 18: Growth gone; voice good. September 30: Tumor returned; voice very hoarse. Two all-night treatments of 300 millicuries each given over the larynx externally. October 7: Growth vanished again. February 17, 1922: Tumor returned; grew rapidly in the last four weeks; voice hoarse again. It seems probable that had internal raying in the fossa piriformis or glottis been possible the tumor would at

least have been kept away for a much longer time. The rapid growth and pain, darting to the ear, appearing in the last few weeks, make the tumor suspicious of malignancy. March 24: Applied 200 millicurie hours in the fossa piriformis, and March 30, 205 millicurie hours in the same place. This internal raying was made possible by hypodermics of $\frac{1}{4}$ grain of morphin each time together with cocain and anesthesin locally. April 3: The tumor rapidly shrinking away. April 15: Tumor gone. Medium reaction in progress.

FIG. 31.—Case III (nonmalignant list). Angiofibroma of the right cord, with phases of its disappearance after external raying. Internal raying used later in the fossa piriformis for return.

CASE IV (July 7, 1921).—Man, aged forty years. Very hoarse and with dyspnea from laryngeal stenosis sent for treatment. Examination shows typical verrucous fibrous chronic tuberculosis. Both sides of the larynx mobile. Cords gone (absorbed); no ulceration. Rayed from fossæ piriformes. Only 139 millicurie hours used, as his intolerant throat kept up constant retching and only short treatments were possible. At present would have used morphin. August 1: Larynx now well open; outgrowths much shrunken; breathes well; tracheal view perfect. Suspended treatment, as he had to go away, but needed more raying.

CASE V (September 9, 1921).—Woman, aged twenty-nine years. Two large singers' nodes at the junction of the anterior and middle thirds of the cords (Fig. 32). Very hoarse. Rayed from the right fossa piriformis. September 22: 104 millicurie hours. October: Selective action of rays strikingly shown, as both nodules became chalky white, due to the death of surface epithelium of nodes, while the rest of the larynx was unaffected. December 13: Left nodule disappeared two weeks after raying. The right one persisted until now, when it too vanished (Fig. 32), showing how slowly but persistently radium acts and how long its influence makes itself felt. March 17, 1922: Voice perfect. No return.

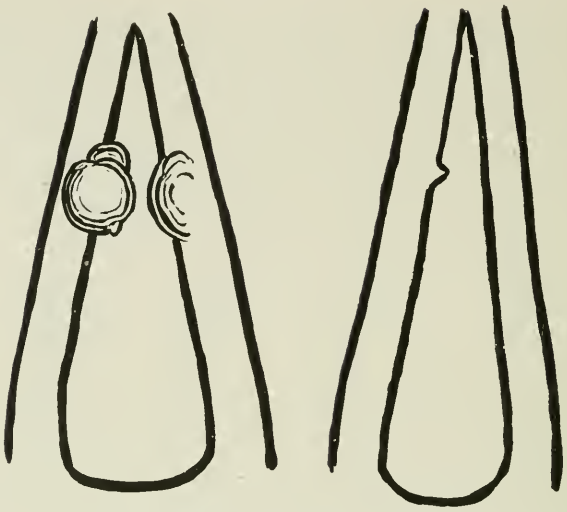

FIG. 32.—Case V (nonmalignant list). Singers' nodes and their disappearance after raying from the right fossa piriformis.

CASE VI (May 28, 1919).—Female, aged eighteen years. Diffuse submucous laryngitis for many months. Whole laryngeal interior irregularly swollen, red and very rough. A granulating ulcer on the posterior wall of the cricoid cartilage below the arytenoids. Cords merge into the ventricular bands, their form unrecognizable. For the past eighteen months the patient has only whispered. December 17 to January 15, 1920: 111 millicurie hours in the glottis. January 15: Marked reaction, swelling and ulcer worse; pain. March 27: Reaction gone; voice natural. Larynx looks normal; ulcer healed.

CONCLUSIONS. *Recurrences.* Among the 27 carcinomas of the larynx treated there were 11 returns of the growths, averaging four and a half months as the interval between the last intralaryngeal radium emanation treatment and the evidence of the return. Among the recurrent cases were those of 6 patients who were predisposed to a return because of the advanced state of their cancers when treatment was begun, all of them being of the type called inoperable, with large tumors or very deep infiltration. The 11 recurrences leave, of the 27 carcinomas, 15 where there was no return; 4 recurrences (Cases VII, XI, XIII

and XIV), including 1 that had made great progress before the patient came back for renewed treatment, have been successfully eliminated by reraying; in another patient (Case V) a great tumor that had been permitted to grow a long time by the patient before he returned, and that occupied the base of the tongue, disappeared completely after renewed raying.

Since the beginning of treatments with emanation in the larynx there have been 10 deaths among the cancer patients. Of these in 3 the disease was so advanced when they were first seen that they were exhausted and moribund; 2 patients had a type of cancer but little influenced by raying; in 3 others the disease in the neck and throat was so advanced when they came for treatment that it was beyond control; 1 patient died of pneumonia, 1 of heart failure, and the first on the list died of general causes and senile weakness after the cancer had disappeared. Deducting these 10 deaths from the list of 27 leaves 17 living patients; abstracting from these 1 patient refractory to radium and 1 who is not quite recovered from his return, leaves 15 patients, including those recovered from their relapse that are at present objectively well out of 27 both dead and living. If the first two-thirds of the 27 patients had had the advantage of the present perfection of the method and instruments employed, and if the intensity of raying now made possible by Dr. F. E. Simpson's greatly increased stock of radium had been available for a longer period, it is probable that the proportion of relapses would have been made less.

*Duration of Treatments and Dosage.* Experience shows that a given dose of emanation rayed from a large amount of emanation in a short time is more effective in destroying a growth than the same dose supplied by a smaller quantity during a longer period. To attain a certain intensity of raying requires a corresponding increase in the number of millicuries placed in the screen used. Within the last three months increase in the radium supply has made trebling the dose of emanation possible, so that a treatment that formerly took from two to three hours can now be given in one. For intralaryngeal raying this asks less endurance of the patient, cuts down the number of treatments, and so the total expense, making them available to those of small means. In

the case of a relapse, instead of having to again go through a series of four or five hours of hour-long treatments two hours of raying will suffice and for prophylaxis from one-half to one hour will be enough. To illustrate: In 1919 nineteen treatments were given the first patient in eight and three-quarter hours in many short sessions over a period of ninety-nine days in order to give 390 millicurie hours of emanation in the larynx. To give 460 millicurie hours to Case XXVII two treatments of one hour each were enough. The improvement of the applicator also permits the tolerance of larger screens and hence larger doses in the larynx. Of great value is the use of a hypodermic injection of from one-eighth to one-quarter grain of morphin preceding the introduction of the screen by twenty minutes. It will, assisted by the local anesthesia, change a most intolerant throat into a most tolerant one.

Lately, on account of the relapses experienced, the standard dose of emanation for a normal series has been increased from the earlier 350 to 400 millicurie hours deemed sufficient to from 500 to 650 millicurie hours. The dose, of course, varies. Thus for a small beginning carcinoma, that has not yet fixed the cord or penetrated the tissues deeply, 350 to 450 millicurie hours will usually suffice; but where the growth is large, and especially if, even though not bulky, it has entered deeply into the laryngeal structure and fixed the cord, 600 to even 700 millicurie hours may be needed to remove it.

*Reactions.* Reactions consisted of pain, cough, reddening, and the formation of a peculiar, white, clinging membrane firmly attached to and infiltrating the epithelial layer of the mucosa and of edema. Where there is much deep cancerous infiltration of the tissues the edema of reaction may be great and cause dyspnea.

The pain, even where there are scarcely any visible signs of a reaction, may be severe, cause much dysphagia, and last for weeks. It is often neuralgic. No reaction occurred with sloughing or destructive ulceration—that is, no burn; but where the tissues were much infiltrated by nests of cancer cells, in the squamous type of carcinoma, the death of so much microscopic cancer tissue produced great amounts of the clinging white mem-

brane mentioned. In such cases it putrefies and causes a foul breath. This occurred in Cases XII and XIX. Under these conditions the membrane casts itself off very slowly and the outlook is not so good as usual, as there is much pain and the condition is chronic and exhausting. Usually this exudate does not appear, and varying swelling and redness with some dysphagia and hoarseness lasting one to three weeks are all that occurs.

In early carcinomas, or fast-growing, superficial, soft, medullary ones, the carcinoma may disappear after one treatment and so suggest letting well enough alone. It is nevertheless necessary that a full raying should be given, the patient being told that a reaction with renewed hoarseness and pain must be created to make a recurrence unlikely.

Experience did not show that renewed raying for a recurrence after an interval of three or more months since the first treatments caused any more reaction than an initial raying, the normal tissues being just as resistant as the first time. This is important, as it shows that a recurrence may be safely eliminated by as vigorous a treatment as needed. In Cases V and XIV there were extensive relapses, but both patients had only slight reactions after intense raying.

It may be difficult to decide whether pain and swelling coming on from four to six weeks after the usual reaction has subsided are due to activity of a very malignant and resistant type of cancer or a renewed, so-called secondary reaction. This happened in Case VI, where what seemed a severe reaction proved to be a rapid fresh growth of a carcinoma excessively resistant to radium.

Occasionally the normal tissues bear raying badly, reacting severely to moderate doses, or else having a mild prolonged reaction for weeks or months. Such patients were XI, XIX, XXI and XXII. Advanced deeply infiltrating carcinomas, and especially squamous-cell epitheliomas, are most liable to give prolonged and severe reactions. Some squamous-cell epitheliomas even possess a resistance to the devitalizing effect of radium almost equal to that of the normal tissues, so that for great doses of emanation and severe reaction but little benefit is obtained. Up to 700 millicurie hours, as total for a series, may usually be used with safety from burns, but in very resistant

carcinomas whose progress is difficult to check it may be necessary to risk even greater amounts. The interval between the usual two or three treatments of a series depends upon conditions. Commonly it is desirable to have the treatments from six days to a week apart, so as to have them all placed before the reaction from the first treatment is in full progress. This will be in about two weeks. During an active reaction raying is inadvisable.

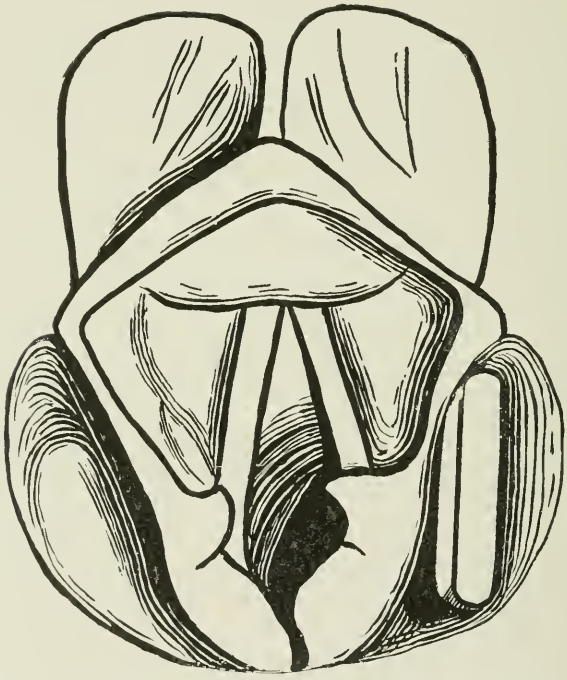

Fig. 33.—Shows a screen placed in the right fossa piriformis.

*Raying from the Fossa Piriformis and Tolerant Larynges.* Occasionally the screen in the glottis causes constant retching and cord spasm in spite of morphin and the free use of cocain and anesthesin locally, making it impossible to keep the screen between the cords. Here the screen should lie in the fossa piriformis (Fig. 33). The distance from the inner wall of the fossa piriformis to the inner border of the vocal cord is only from

one-quarter to three-eighths of an inch, with merely the aryepiglottic fold and arytenoid cartilage to traverse by the rays. Where a carcinoma grows upon the surface of the cord and seems of the resistant squamous-cell kind it is desirable to ray it with the screen directly upon it; but if, as is often the case, the growth has penetrated the ventricular band and the musculature of the cord, and therefore entered deeply into the structure of the larynx, the fossa piriformis becomes the location of choice for the screen for at least one-half of the raying, as it has the advantage of representing the center of the invaded area, making raying both outward and inward possible through suspicious territory. If by reason of excessive laryngeal intolerance the patient can only be rayed from the fossa piriformis, my experience shows that the growth usually disappears as speedily from the cord as if the screen were placed in the glottis. An advantage of the fossa piriformis position over that in the more sensitive glottis is the far greater tolerance of the fossa piriformis, so that a much longer raying is possible there, and, with the aid of morphin, displacements of the screen do not occur from the fossa.

*External Raying for the Removal of Tumors of the Larynx.* Raying of the larynx through the tissues of the neck from outside, even if intense and prolonged for seventeen hours, with from 300 to 500 millicuries of emanation, has too feeble an effect to be reliable. In the cases in which it was used without internal raying to assist it, small growths indeed disappeared, but soon returned and larger and advanced ones were hardly influenced.

*Excision for Microscopic Diagnosis.* These were only made where it was necessary to justify raying in doubtful cases. Thus in Case IV a little lymphoid-looking nodule, seemingly innocent, was proved malignant by the microscope. Merely to sustain an obviously correct clinical diagnosis of carcinoma by a histologic one, where symptoms and aspect were typical, was not deemed proper considering the general experience that cutting into cancers may spur them to rapid growth.

The unreliability of diagnostic excisions in cancer was shown by Case XIX, where large and deep-seated pieces obtained from a large mass, removed because it threatened suffocation, showed microscopically only pachydermia. This made the clini-

cal diagnosis of carcinoma uncertain and the choice of a definite course of treatment difficult until later pieces from a second clearing out of the larynx showed typical epithelioma. To find a piece containing cancer tissue in all of the schirrous carcinomas, and from larynges edematous from deeply hidden cancers, would have required resections of large parts of the cords or arytenoids, making restoration of the functions of these parts by raying impossible, and with these mutilations often missing the sparse cancer tissue hidden in cicatrices or buried in deep edemas. Timid superficial diagnostic excisions are liable to grasp merely the epithelial layer of the mucous membrane, giving a misleading negative report. It is seldom that the signs and symptoms of carcinoma, such as fixation of the cord, pain shooting to the ear, deforming edemas, usually unilateral, and the patient's age and history leave any doubt. Nowadays syphilis is easily excluded.

*Selective Action of the Radium Rays and Prognosis.* Unlike the other ways of removing cancer, which, with the exception of the roentgen ray, destroy the normal with the pathologic tissue, radium possesses the power to take the life of the cancer cells and other cells of low vitality while sparing though lowering temporarily the life of the normal cells. Cancer cells of very low vitality, as those of the rapidly growing soft cancers, succumb to astonishingly small doses of emanation that do not perceptibly affect the healthy flesh at all, while, unfortunately, other cancer cells may possess a vitality almost equal to that of the normal tissues and be but little influenced by great amounts of raying that profoundly affect the healthy tissues and create violent inflammations of long duration. Such resistant cancer cells may be made merely dormant over a variable period by raying and begin to grow again as soon as they have regained their vitality. Not only the cancer cells vary in their vitality but the tissue cells also, so that the combination of tissues that feebly resist raying with a cancer strongly resistant to it gives a hopeless prognosis. The patient's chances, therefore, depend largely upon the proportionate vitality of the tissue cells and the cancer cells, and to foresee just what this is cannot be told at present. Where this proportion is favorable to the patient, raying gives some marvellous triumphs, and the fading away of the cancer with the emergence

of normal parts, especially the white cords, with returning motion where fixed, is one of the delightful wonders of practice. It is remarkable how long the cords can endure being imbedded in cancerous masses and edemas and yet remain intact before the strangling pressure of the cancer leads to their complete atrophy and disappearance, an atrophy that takes place usually without ulceration. Cases XIII and XIV are examples where raying came too late to save the cords, and Cases XXII and XXIV show where the cords were not only freed but even became mobile again.

*Involvement of the Neck Glands.* The heavy all-night seventeen-hour external treatments of from 300 to 1000 millicuries applied now, as the rule, by Drs. Simpson and Flesher for the removal of cancerous glands from the neck, have been more effective than the weaker doses that were formerly the only ones available. Even large, fixed collections of glands may disappear completely or leave inactivated remnants. This greater control of the lymphatic extensions of carcinoma of the larynx may save the day in cases that formerly were hopeless.

*Prophylactic Raying.* Considering the tendency to recurrence possessed by a proportion of the cases, especially advanced ones, it is advisable to give the patient at intervals of from three to six months a prophylactic treatment of from 200 to 300 millicurie hours.

*Treatment of Benignant Growths and Chronic Hypertrophic Laryngitis with Emanation.* Selective action of radium and the effectiveness of raying from a fossa piriformis are strikingly shown in Case V of "Supplementary Conditions," which follow the carcinoma list. The patient had two large singers' nodes and the raying came from the right fossa piriformis only. The nodes turned chalky white in a few days and disappeared in time while the rest of the larynx remained normal. Only 104 millicurie hours were used. The multiple papilloma described in Case II of this list also quickly vanished, leaving the larynx normal, and in the case of chronic hypertrophic laryngitis mentioned emanation changed a hopeless situation into a perfect recovery with restoration of the voice. These nonmalignant conditions yielded to far smaller doses than the malignant ones and have stayed well.

They indicate that round-cell infiltration and hypertrophied epithelium succumb readily to raying. This experience shows that raying can displace the usual forceps and suspension operations for innocent growths.

The experience gained from the cases here described confirms my opinion that, in spite of possible recurrences, radium emanation, applied intralaryngeally as described, is the best existing remedy for laryngeal carcinoma, either intrinsic or extrinsic. The ready control and removal of cancerous returns and the absence of increased vulnerability of the normal tissues after an interval of three months or more have made the outlook unexpectedly favorable for patients with recurrences if reported early enough.

General surgeons of note still teach that laryngotomy or laryngectomy, partial or complete, represent the only treatment for carcinoma of the larynx. The series of cases here described disproves this. Life for these patients who have been rayed and become clinically well of carcinoma of the larynx, possessing speech ranging from a loud natural voice to a good whisper, and with all evidence of carcinoma gone, is surely preferable to a life after laryngectomy, voiceless, without a larynx and breathing through a hole in the neck instead of the nose, especially as the operations mentioned do not ensure against recurrences which are liable to produce inoperable conditions. The prospect of an operation with a high mortality and a serious mutilation makes the patient inclined to postpone the operation until the tumor's advance has greatly lessened his chances. There is no such dread of raying, which is therefore sought earlier, and in place of mutilation offers a chance even of voice restoration.

A large proportion of patients will be freed from their cancers by raying and may be kept well by prophylactic treatments, or, as far as my experience shows, will stay well without them. As for all methods of treatment for laryngeal carcinoma the earlier raying is applied the better the outlook, but even advanced cases may be brought to clinical recovery where the growth is of the yielding kind, and this offsets the few refractory types of cancer of the larynx that resist raying.

The past year has done much to improve the method. It is to be hoped that future years will further develop it and make the outlook still better.

## Discussion

Dr. D. Bryson Delavan, New York:

All who are working in the same direction as Dr. Freer will agree that the study of radium is still in the experimental stage. We are earnestly trying to learn the truth about it. Anything which will reveal the truth we welcome, whether favorable or adverse. Each one of us, be he in the realm of surgery or not, is striving for one and the same end—the prevention of suffering and death. When any one resource has been proved superior to others, by all means let it be adopted.

With regard to alleged cures of laryngeal cancer, the expression "cured" is unfortunate. Some of the older operators claimed a case cured which had lived for one and one-half years without recurrence. In the case of my own, of a minute epithelioma of the margin of the epiglottis, one-third of the epiglottis was removed apparently far and wide of the growth, with complete success for nine years. Then the disease reappeared in the stump of the epiglottis and extending rapidly caused the patient's death. Only yesterday we saw at this meeting a specimen of carcinoma of the larynx from a man successfully operated upon twenty years ago. This certainly was a most instructive lesson. The critical opinion given by an observer as to the visible results in a given case must be understood as personal to the observer and, as a matter of fact, conjectural. The testimony of one observer may not agree with that of another as to the actual conditions present. In a case where several competent observers have arrived at the same conclusion it is fair to suppose that their report is, as nearly as possible, correct. How can it be positively known that any case is "cured" and secure from recurrence, whether treated surgically or by radium or by any other means? Time alone can prove the result, and time may be an uncertain test. With regard to the possibility of metastasis in laryngeal cancer, not referring to glandular involvement, I have not noticed any particular tendency in that direction.

My associate at the Memorial Hospital, New York, Dr. Douglas Quick, has prepared a review of 156 cases of laryngeal cancer treated with radium at the above institution during the last five years. The summary which he gives is of the greatest interest. His conclusions based upon elaborately studied material have been elaborated with all possible accuracy and care. They are offered in the hope of somewhat advancing the knowledge of the subject, while admitting that

much is yet to be learned. The author's impressions of conditions observed have been confirmed by other competent examiners.

*Summary of Dr. Quick's Conclusions.* 1. While radium offers a hope to a larger number of cases of cancer of the larynx than the older methods, its use must be considered to a certain extent as yet experimental.

2. Before treatment of a laryngeal neoplasm is undertaken proper classification, based upon what can reasonably be hoped for, should be made and the method and intensity of treatment governed accordingly.

3. While treatment of primary operable intrinsic cancer of the larynx is permissible the evidence to date does not warrant advocating it as the agent of choice.

4. It is suggested that the preoperative use of radium in operable cases would add materially to the end-result.

5. Surgical exposure may frequently be used with advantage in radium localization.

6. The radical use of intensive radiation is permissible in cases offering a reasonable hope of complete recovery.

7. The conservative use of radiation in inoperable cases offers palliative relief in a large percentage.

8. Radium should be withheld in the very advanced cases.

Dr. Chevalier Jackson, Philadelphia:

I should like to ask Dr. Delavan for further information in regard to the preoperative use of radium, as to its advisability, as to whether or not there should be a definite lapsed period after the raying before the operation, and as to its effect, if any, on the healing of the operative wound.

Dr. Cornelius G. Coakley, New York City:

At the meeting of the New York State Medical Society in April this year there was a symposium on the treatment of cancer of the larynx by three different methods: One with radium by Dr. Quick; another, laryngofissure, by Dr. Jackson, and total laryngectomy by Dr. Mackenty. I was invited to take part in this discussion and I asked Dr. Quick if I might have the privilege of seeing some of his results of the use of radium in what he would consider favorable cases at the Memorial Hospital. I went to the hospital and saw there 10 cases selected from the 150 odd which had been radiumized. Now of these 10 cases 1 was a sarcoma of the larynx in a woman, and the result there was perfectly wonderful. She had a perfectly clean larynx, the

radiation had been done something like two or two and a half years, I cannot remember exactly the dates, and she had an excellent voice. She had a perfectly smooth larynx, no evidence of thickening anywhere within the larynx, and certainly cure could not have been obtained for that condition, inasmuch as it was a bilateral involvement of the larynx, I think, except by a total laryngectomy. Here was a woman with a good larynx, a good voice, and, so far as we could see, no possible evidence of recurrence. We saw also another case, an epithelioma involving the pyriform fossa, the epiglottis and the aryepiglottic folds. Section had been taken of that case and found to be epithelioma. There was a perfectly good, smooth, nonnodular scar, most of the epiglottis was gone, the aryepiglottic fold was in perfectly good shape, and that case had been observed for a period of two or two and a half years since the application of radium. I would regard that as a very excellent result. The third case which I saw was a man with a bilateral involvement of his larynx of somewhat over a year since the last application of radium. He had a very fair voice, husky, the cords were both slightly thickened and nodular, slightly reddened, much like some of the cords we see after some very bad papillomatous condition. The condition was excellent, but I cannot be positive, from clinical appearance, that some of that nodulation might not contain some dormant epitheliomatous or cancerous cells which some time, a year or two hence, might not start to grow and a recurrence be noted. Next he showed a case that I had seen in my office, a private patient, some two or two and a half years ago, which he claimed was a cure. The man had involvement of both of his cords and ventricular bands and I advised him that total laryngectomy was the only chance he had of living very long. He positively refused operation. Radium was used and he was shown to me as a cure. He had nothing but a whisper voice, he had in the upper part of his larynx still some thickening in the ventricular bands, cords moderately thickened, and he had a mass extending from the anterior commissure probably into the trachea and thickening which I would estimate at being three-eighths of an inch to greater than that in thickness, irregular in size, and involving both sides of the larynx subglottically. I suggested to him that the case could not be considered as cured. He told me that they had made direct examination of this patient and what I saw was nothing but scar tissue. I doubt that, because in such cases there are practically always carcinomatous cells left in that thickening, and it is practically only a matter of time before recurrence takes place; and so while this man has had two years of life and been very comfortable, I do not think there is any doubt but that time

will show that that patient will have a recurrence. Another case was shown to me in which they considered it a cure. The whole of the right vocal cord had been involved in this carcinoma. No section was taken. The anterior part of the right vocal cord was visible and not implicated with any inflammatory or other process, but he had in the region of the arytenoid a swelling as large as a hazelnut. I said to the Doctor, "I cannot tell what is underneath this," and this was six to nine months after operation. I said: "You cannot put that down as a cured case because there is something going on there, and the probabilities are that there is carcinoma still under the edema. Of the other cases shown to me not one of them but presented clinical evidence of recurrence. So that it does not seem to me that sufficient has been accomplished yet. In small superficial involvement radium when properly used and in sufficient doses can, of course, destroy all of the disease; but it seems to me that the cases that have been presented here today are going to do a great deal of harm by pretending to cure a disease that is only arrested for a time. It is wrong to report as cured cases in so short a time. As I recall it, this case on the third chart, lower side, was one that was reported last year to our Association as cured where no sections had been given. Is not that the one?

Dr. Freer:

The fifth chart was reported last year.

Dr. Coakley:

That is the one in which no section was taken, and you said the cord was perfectly normal. Now within a year there is a lesion on the cord at the same site, and I cannot help feeling that that lesion is a return of the same process that was going on a year ago. Whether a larger dose is going to destroy the remaining cells or is going to leave some that will lie dormant a year or two and then start up again we do not know. There is one phase of the Doctor's paper, and that is this: I have seen it in other radium cases, namely, his speaking of metastasis. Now before radium came into use I cannot recall of a single case of carcinoma of the larynx in which the patient died of metastasis in other portions of the body. Perhaps my clinical experience is different from others. But with the use of radium, especially as used years ago, in smaller doses, before we knew as much about it as we do now, I have seen a number of cases of metastasis, and I really cannot help feeling that what radium does in some cases when not used in proper doses is to help make a condition in which metastasis may occur more

frequently. It is unfortunate to report cures in a few months from the action of this agent.

Dr. Henry L. Swain, New Haven, Conn.:

I suppose Dr. Coakley would not want the whole larynx taken out if he had a small growth on the cord. He would like, as I know I would for myself, to have the possibility of cure by some such means as radium thoroughly tried out before he would want to undergo the gross surgical procedures. Being desirous that the question I am about to propound should be answered definitely, I will ask Dr. Freer and Dr. Delavan what evidence there is that the normal healing of the tissues after the exposure to the roentgen ray will be disturbed? I mean if one had radium used with the intention of destroying a growth and failing in that desired to have an operation, have you any way damaged the possibilities of that case by the use of radium? That is question No. 1. While I do not quite agree with all that Dr. Coakley said, nevertheless we must in the face of things consider very earnestly what he has brought forward. This question of the appearance of metastastis after the parent growth seems to have been cured by raying is most important. We must contemplate it and year after year bring in our clinical experience gained by carefully observing our patients as to this particular point. If physicians the world over could coöperate in correlating their experience with radiation we could soon settle whether the metastastic growths were there to begin with or came in spite of its treatment, not because of it. If I may divert to ask another question of Dr. Freer, I would like to know how long his longest reaction has existed following the exposure to one dose of radium, massive or otherwise?

Dr. Freer:

The idea is this, radium does influence some the healing of tissues. I excised a large lymphosarcoma from the neck and rayed it at the same time. It was rayed with radium. It certainly helps the healing very considerably. I think we may say that three weeks will have to elapse before the tissues will acquire their normal capacity for healing.

Dr. Fielding O. Lewis, Philadelphia, Pa.:

Dr. Freer, I assume from his applicator, uses the salts of radium. Is that correct?

Dr. Freer:

Only emanation. I have never used salts of radium at all.

Dr. Lewis:

At the radiological clinic of the Philadelphia General Hospital, which has only been in operation since February, we have been burying emanations (as I understand this is the method used at the Memorial Hospital of New York) into the growth, whether it be in the larynx or in the base of the tongue. It would seem to me that this method is perhaps as efficacious and less uncomfortable to the patient than using applicators such as Dr. Freer has described. I am much pleased to hear him state his results in the treatment of nonmalignant growths of the larynx. I have had two very remarkable results in which radium needles were inserted into the larynx. Both had been operated on repeatedly for the removal of papilloma. After the application of radium it would be almost impossible to state that the patient had ever had any laryngeal growth.

Dr. Freer:

I want to take as little time as possible. I have quite a few punches to answer. In regard to Dr. Delavan's very extended discussion, I should like to ask him what was the dosage in millicuries?

Dr. Delavan:

The dosage depends altogether upon the case.

Dr. Freer:

And how applied and where.

Dr. Delavan:

Extrinsic, intrinsically, mainly through emanations. Many were treated with large doses extrinsically.

Dr. Freer (closing):

Intralaryngeal radium therapy is still much in the stage of development, and ten years may go by before the needed variations in dosage, intensity of raying, and the amount of time over which a given dose should be spread become defined with complete accuracy to fit the varieties of disease in the larynx met with. It is desirable, therefore, that this new branch of laryngology be taken up by more laryngologists than heretofore, and it is of the greatest value to it that so eminent a leader as Dr. Delavan is giving intralaryngeal raying with emanation his attention, as it requires the seasoned judgment and large experience of such men to give it the definite place in therapy my past year's experience shows me it deserves.

As Dr. Delavan says, relapses are to be expected from any method of treatment of laryngeal cancer, laryngectomy included, and one of the most important tasks before intralaryngeal radium raying is to study how to head off relapses.

Dr. Coakley refers to the emanation treatment of a large number of laryngeal carcinomas in a New York hospital, which he says has so great a supply of radium that the dose of emanation may be made so large that it may be given in a few minutes, thus making it possible to treat the patients by direct laryngoscopy with the radium carrier held in an assistant's hand; but he cannot tell what dosage in millicuries is represented by the vague term large. The exact dosage of emanation and the time in which it is applied are of such great importance in the description of any method of its use that any reference to emanation therapy is of no value that does not at least approximately give the number of millicuries employed and length of time used in the application. The radiologist of the hospital in question might consider a number of millicuries a "large" amount that I should think an inadequate dose if given in the few minutes Dr. Coakley regards as time enough for the supposedly large doses about whose amount in millicuries he says he is not informed.

Considering the limited size of the screen the laryngeal interior will tolerate it would take, for instance, the collossal dose of 1200 millicuries in a four-tube screen to give, in fifteen minutes, the equivalent of 300 millicuries applied for one hour, that is, a full standard dose. It is the experience of radiologists, however, that the shorter the time in which a given dose of emanation is given the more intense will be the reaction, and therefore the greater the undesirable but unavoidable injury done the normal tissues that is inseparable from radium treatments. In the case of very large doses given in a few minutes the devitalization of the normal tissues may be so great that it will take many weeks before recovery has gone far enough to make further radium treatment possible, treatment which may be urgently needed. So it is not the same thing if an emanation dose be given in a short or a long period. It may be desirable in cases in which the patient has proved very sensitive to radium to use a long time of application and a mild dose, while for patients who have reacted but little to previous rayings a larger dose in a shorter time may be best. The method of application suggested by Dr. Coakley would possess no such flexibility, because for all patients it would be necessary to use the short time and heavy dose, for the method of application, by hand, using direct laryngoscopy, can only be employed for a very short time because direct laryngoscopy is a forcible entry into the larynx involving the

straining of pharyngeal, tongue and jaw muscles, calling forth retching and glottis spasm, which, together with the unsteadiness of the hand making the application of the screen to the cancer, cause the placing of the screen to be inaccurate and lead to its constant displacement. In contrast to this, mirror laryngoscopy leaves the parts of the throat involved in their natural relations, causes no straining, and, combined with the absolute exactness of the placing and maintaining in place of the screen with my apparatus, gives a method of treatment not to be compared with the primitive manual procedure mentioned by Dr. Coakley, a procedure I tried and discarded years ago. As with local anesthesia, it is perfectly easy, with the aid of the laryngeal mirror, to place the screen anywhere in the larynx where desired. I cannot imagine why direct laryngoscopy should be resorted to at all, even when the applicator is held by hand.

Considering, therefore, that the method of application in use in the hospital in question is quite unlike mine, and is a method that to my thinking is haphazard and inaccurate, I do not see how that hospital's experience with emanation in the larynx can be used in criticism of my results or of radium emanation treatment of laryngeal carcinoma in general when properly done.

I am pleased to find that in this hospital the seed implantation has been discarded for the raying by means of screens containing emanation. The seeds act intensely within $\frac{1}{2}$ cm., but their feeble strength, about 1 mc. at the most, gives them no raying power beyond their immediate vicinity, so that at the point of introduction the radium action may even create sloughs, and, nevertheless, leave peripheral dangerous cancer areas of microscopic invasion untouched. As I stated last year, it is necessary to use a raying source of sufficient penetration to metaphorically light up the whole thickness of the neck in the diseased area. Seeds cannot do this. Besides, they are better adapted to fleshy organs like the tongue than to a cartilaginous frame covered with thin muscles and mucosa like the larynx.

Dr. Coakley suggests that in the cases portrayed in my illustrations as freed from cancer he would have seen cancerous foci. All of my drawings I personally sketched from life with great care, copying every detail. They are minutely correct and nothing has been omitted.

Dr. Cornelius G. Coakley, New York City:

I know that Dr. Quick has an instrument that is shaped very much like your applicator, in which he has some way of applying emanations. I do not know about radium any more than Dr. Delavan does, but he has a large amount of emanation which he places in a small capsule at

the bottom of a tube, curved very much as yours, and which he leaves in but a short time because of the large dosage they have available. It is applied either by indirect or direct examination and held against the mass. He (Dr. Quick) is of the opinion that it is going to be more serviceable for him than the implantation of radium emanations in these small seeds. These implantations of emanation seeds are done under direct examination, where they can be accurately placed in the mass at whatever situation seems most desirable. They are introducing several, anywhere from two, four or five, in accordance with the size of the mass. There can be no question as to where he is going to introduce them; he does it accurately.

Dr. Freer:
Does he use suspension?

Dr. Coakley:
No, direct tubal examination.

Dr. Freer:
He does not use a mirror?

Dr. Coakley:
He does use a mirror for the indirect work, but trusts considerably to direct examination of the larynx. They use a broad spatula; he lifts the epiglottis, which gives you an excellent view of the larynx, sometimes under local and sometimes under general anesthesia. Is that right, Dr. Delavan?

Dr. Delavan:
That is right.

Dr. Coakley:
I am under the impression that Dr. Quick uses much larger doses put into some sort of container shaped much as your container, but not held in that position by a mechanical instrument, but held there at the time of application by an assistant, guided by a mirror, and much of it by direct method; but with the large doses that he has he believes five to twenty minutes to half an hour is sufficient. I presume he uses larger doses than you.

Dr. Freer:
I doubt it. I use up to 300.

Dr. Coakley:

He has three times the dose.

Dr. Freer:

Three hundred millicuries, not hours. I frequently find half an hour is enough, forty minutes is the limit, but the absolute stability of the thing and the absolute accuracy of the application, I suggest that he get one of these head clamps. The assistant's hand is not steady and the least motion will start radiating. I would not regard that method as accurate. I am delighted to hear Dr. Quick is reaching the same conclusion that large doses of emanation are the correct thing.

# THE CONTROL OF EARACHE THROUGH THE NASAL (SPHENOPALATINE—MECKEL'S) GANGLION

GREENFIELD SLUDER, M.D.

The relief of earache through or by means of the nasal ganglion apparently falls into the category of those cases of ocular, mandibular and glossal pain that can be relieved in this way. No anatomical facts can be offered as explanatory of these phenomena.

Earache is not an uncommon feature in the syndrome of nasal ganglion neuralgia and may be an isolated manifestation. In these cases examination of the ear is negative in every way. This fact has been mentioned often in the course of the description of that syndrome.

Recently I have discovered that the pain of inflammatory disorders of the middle ear in patients who were not sufferers from nasal ganglion neuralgia could be stopped by cocainization of the nasal ganglion. To what extent or what frequency this may prove true I do not know at present. It appears, however, to be a phenomenon worthy of investigation. Its therapeutic value would seem obvious were it a fact of reasonable frequency.

I have had 9 cases of earache accompanied by more or less congestion of membrana tympani, 1 with obliteration of the landmarks without pouting, 2 middle-ear abscesses with pouting, 1 general reddening of the membrane with tinnitus, and the others with congestion of the handle of the malleus (Eustachian tube cases) that were relieved by cocainization of the nasal ganglion. In one of the abscesses the relief was for a few minutes only. In this case there was reason to think that only a very small part of the cocain was absorbed. In the other case the relief was complete, but it did not at all prevent the pain of paracentesis. In the case of reddened membrane with tinnitus the relief of pain and tinnitus was complete with one application,

and they did not return. This was true of the case with the obliterated landmarks of the membrane and the cases of slight irritation of the Eustachian tube.

In the last volume of *Arch. f. Laryngologie*, No. 34, Dr. Bruno Goldschmidt-Osmund records some most interesting observations on headache relative to the sphenoid and nasal ganglion, one of which is the categorical statement that all syphilitic headache is controllable by cocainization of these parts. This is another phenomenon to be added to those without anatomical basis as explanation.

Two most interesting observations in this category have been made very recently. Dr. W. M. C. Bryan, at the meeting of the Laryngological Section of the St. Louis Medical Society, April 20, 1922, reported a case in a man, aged thirty-five years, of herpes zoster of the rami zygomatici temporales and rami zygomatici facialis branches of the maxillary and nervus supraorbitalis and nervus frontalis branches of the ophthalmic, with pain in the distribution of these nerves and deep in the eyeball. The patient said he thought his eye "would burst." The pain in the forehead was controlled by the application of one drop of saturated solution of cocain muriate through the ostium of the sphenoid. The pain in the eye was uninfluenced by this. Application to the sphenopalatine foramen region relieved the pain in the eye. The pain in the temple remained, explicable probably because the application to the sphenopalatine foramen anesthetized only the Vidian side of the ganglion and did not influence the maxillary nerve, which coincides with the argument that the control of the severe pain described as inside the eye by cocainization of the nasal ganglion is accomplished through or by means of the sympathetic nerves.

The second observation is reported by Dr. Louis K. Guggenheim at the meeting of the Laryngological Section of the St. Louis Medical Society, April 20, 1922, in which he records a case of a woman, aged seventy-five years, who had an acute, intense earache with throbbing, accompanied by great pain in the mastoid and tragus and upper part of the external canal and marked tenderness to touch. The drum and canal were normal on inspection. One-half grain of codein every three hours failed

to relieve the pain. No rhinitis or paranasal cell disease was recognizable. Application of 5 per cent solution cocain muriate to the nasal ganglion region stopped all pain and the tenderness to touch in the canal and tragus. The application was made twice, after which the pain did not return.

I have stopped the earache secondary to tonsillectomy by cocainization of the nasal ganglion.

# THE CONTROL OF MANDIBULAR PAIN THROUGH THE NASAL (SPHENOPALATINE—MECKEL'S) GANGLION[1]

GREENFIELD SLUDER, M.D.

Since 1908[1] I have from time to time been surprised by phenomena apparently originating in or controllable through the nasal ganglion. Some of them have permitted of explanation more or less on an anatomical basis; others, however, have not been possible of explanation on such basis according to our present anatomical knowledge. The control of pain in the lower jaw through or by means of the nasal ganglion belongs in the second category.

The first observation of this phenomenon was accidental. A patient who was subject to recurrent attacks of nasal ganglion neuralgia appealed to me for relief from an attack with which he had become familiar through experience, stating that in addition he had a very painful wound in his lower jaw where a molar tooth had been dug out with much difficulty. The wound was thirty hours old and inflamed. I anesthetized the nasal ganglion and found that the pain in the wound was stopped as well as the neuralgia.

Since then I have had four painful wounds of the lower jaw, made by the extraction of teeth, in patients who were not sufferers from nasal ganglion neuralgia. In them the pain was stopped by cocainizing the nasal ganglion. The relief was of several hours' duration, and in one it did not return.

I have not yet had the opportunity of trying this action on ordinary toothache.

Dr. W. V. Mullin wrote to me that in a case in which all the

[1] Sluder, Greenfield: The Role of the Sphenopalatine (or Meckel's) Ganglion in Nasal Headaches, New York Med. Jour., May 23, 1908.

lower teeth had been extracted in vain for pain he had been able to stop the pain by cocainization of the nasal ganglion, but gave me no other details of the case.

The possible therapeutic value of this observation has not been determined.

## Discussion

Dr. Lee Wallace Dean, Iowa City, Iowa:

Before I left home I asked my secretary to make a note regarding a case of glossodynia which I observed a number of years ago: Three years ago a woman, aged about fifty-eight years, came under my observation complaining of glossodynia and with the diagnosis of carcinoma of the base of the tongue. She was sent to me for the removal. Three years before I saw this patient she suffered from mild coryza accompanied by pain, localized on the left side of the throat and tongue. In the course of weeks, perhaps months, this pain became localized to the throat itself. It was the ruling thing, a real neuralgic pain. Examination of the throat was negative. No evidence of any lesion. Injection of the left ganglion gave complete relief. Mild sphenoiditis was found. I have seen this woman in every year, in one way or another, in the three years that have elapsed, and it is one of those cases where we can secure this very sudden, complete and permanent relief, and to this day the woman is a very grateful patient. I should like to ask Dr. Sluder one question. Occasionally I find that I am unable to inject the nasal ganglion notwithstanding the fact that I have received instructions from Dr. Sluder directly. One of the men in my service maintains that you can inject the nasal ganglion by the external route. This is the gentleman who does the work in making large injections in the fifth nerve and Gasserian ganglion for neuralgia. Be that as it may, I attempted the injection of the sphenopalatine neurons about a month and a half ago with a very miserable result, and I had this patient back and the gentleman attempted injection by the external route nine days ago, and the patient was back seven days after the injection, with relief. To my mind I am not certain whether he got the second division or ganglion. I would like to hear from Dr. Sluder.

Dr. Greenfield Sluder, St. Louis, Mo. (closing):

Dr. Dean told me of the observation for the control of glossodynia, and since that time I have injected the nasal ganglion in three old and obdurate cases. If anyone has had experience with glossodynia (there is a classical description in Sir Henry Butlin's *Diseases of the Tongue*), such cases will be understandable. He calls attention to an inflamed papilla at the palatoglossal junction. I have removed that papilla without relief of the glossodynia. These patients are terribly harassed in mind; they always think they have cancer; and it is with great difficulty that we persuade them that they have not. To find something that can and does control glossodynia seems to me the most valuable contribution to the subject. As I said, three obdurate cases of glossodynia were treated by me. After years of persistence of the pain they have been relieved. Dr. Dean spoke of not being always able to inject the nasal ganglion. I think probably it is food for thought for all of us—we do not always inject the nasal ganglion. We inject in the vicinity of it and often get results in that way. Experiment on the cadaver showed that a needle put through under the posterior tip of the middle turbinate uniformly landed, if not in, certainly very close to it. You cannot always get through into it from under the middle turbinate, as the bone is often too thick and hard. You can always turn around the tip of the middle turbinate and go through the sphenoid palatine foramen. The recommendation I would make is that the straight needle be abandoned and the curved needle used to curve around the posterior tip of the middle turbinate in such cases, and that can be guided under the pharyngoscope, as advocated by Dr. Edgar M. Holmes some years ago; or after your needle goes through the foramen you can feel it in the foramen. You can feel it go through and then you get an anteroposterior play of your needle in soft tissue by something more than an eighth of an inch, probably more nearly a quarter of an inch, and I recommend that procedure for anyone who has trouble with the straight needle.

# EXPERIMENTS WITH ATMOSPHERIC PRESSURE IN THE MAXILLARY SINUS

ROCKWELL A. COFFIN, M.D.

A REVIEW of the literature dealing with atmospheric pressure in the maxillary sinus shows that there has been very little investigation of this subject. The question of demonstrating the atmospheric pressure in the sinus maxillare was first suggested to the writer and his assistants by two cases presenting subjective symptoms of antral infection in which the transillumination, roentgen findings, and experimental puncture were negative. With the expectation of finding negative pressure, we obtained an instrument for measuring pressures less than that of the atmosphere, but as this instrument recorded nothing we consulted Mr. Purington, of the Crufts physical laboratory at Harvard University, and he was kind enough to make for us an instrument that measured both positive and negative pressure. This instrument is the simplest form of a U-shape manometer. At the time of the making of the instrument it was suggested to us that we could avoid errors by using alcohol instead of mercury. All terms, therefore, in these investigations will be expressed in centimeters of the alcohol manometer. In this connection we should also state that Prof. Hersey, of the Massachusetts Institute of Technology, has given us valuable advice in regard to the avoidance of error in following out the technic we have adopted. Other than the manometer itself we used nothing but a conical puncture needle and a piece of rubber tubing, about two feet long, sufficiently strong to resist ordinary pressure. We chose this particular shape of needle to prevent the escape of air at the point of puncture. We made an application of adrenalin and cocain under the inferior turbinate, selecting this point because of the thicker bone, thereby lessening the possibility of the escape of air about the cannula. After the lapse of five minutes we introduced the puncture needle

into the sinus, and then taking a wire a quarter of an inch longer than the cannula, passed it through the cannula to make sure that the cannula was in the antrum and to remove any blood or secretion which might have been drawn into the cannula, for the presence of any fluid here would very easily affect the reading on the manometer. We discovered that the cannula and the tube should be kept about the same temperature as the body, to prevent condensation of moisture in the tube, for this also would cause inaccuracies. The connection between the needle and the instrument, we found, must be made very slowly, to prevent backward pressure. For the sake of brevity we have classified these cases into two groups, normal and abnormal.

Group 1, without symptoms or any recognized abnormalities:

CASE I. 2 cm. +.

CASE II. 1.5 cm. +.

CASE III. 2 cm. +.

CASE IV. Nothing recorded except on forced expiration, which gave 3 cm. +. Inspiration, 2 cm. —.

CASE V. No symptoms. Normal-looking nose. Normal pressure except on inspiration 3.75 cm. —. Expiration, 1 cm. +.

Group 2, in which there were marked enlargements in the region of the anterior end of the middle turbinate and other obstructions in the nose:

CASE I.—Pain about the right eye. Middle meatus closed with polypoid tissue. On first introduction of the needle the instrument recorded 2 cm. + and after three minutes 0.25 cm. +. After forcible blowing of the nose it registered normal. Probably in the act of blowing the needle was dislodged, which allowed an escape of air.

CASE II.—Pain now and then following extraction of teeth. Septum thickened on the right side opposite the middle turbinate and showing marked anterior deviation. Unusually small amount of secretion. 1.8 cm. + after five minutes. Radiographic findings negative.

Case III.—Four years, headaches with pain in various parts of the head. No discharge. Previous septum operation. Radiographic findings negative. With the exception of hypertrophy of the anterior end of the middle turbinate, which was in contact with the septum, no abnormalities. 2.25 cm. +, but on forced inspiration the negative pressure was so marked that the alcohol in the manometer disappeared through the tube into the sinus, thereby registering more than 12 cm. —. On forcible exhalation 7.75 cm. +.

Case IV.—Difficult breathing at night. Nose open, with the anterior tip of the middle turbinate not in contact with the septum. Nothing was recorded except on forcible exhalation, which then registered 3 cm. +. Forcible inhalation 2.5 cm. —.

Case V.—Obstructed breathing on the left side. Headaches over the eyes, especially after use of the eyes. Nose blocked with hypertrophy of both middle and lower turbinates on both sides and the nose rather narrow. Normal pressure except on exhalation, 2 cm. +. Inhalation registered 1.4 cm. —. Radiographic findings negative.

Case VI.—No secretion in the nose. Discharge from the left ear with large perforation of the drum. Turbinate moderately dilated. Normal with respiration at rest. 1 cm. + with normal expiration and 2.5 cm. + when forced. Normal inspiration registered nothing, but when forced went to 2 cm. —. Radiographic findings negative.

Case VII.—Large spur. Polypoid thickening of the anterior end of the right middle turbinate with apparent obstruction of the ostium, 4.8 cm. +. No change during respiration. Patient sent to be radiographed but did not report.

Case VIII.—Polypoid tissue filling both sides of the nose. Frontal headaches. Roentgen ray showed cloudy antra and frontal. Secretion in both sides. Only 0.8 cm. + and no change when breathing.

Case IX.—Obstruction in the nose for many years. Polypi have been removed several times from both sides. Secretion in the nose. Normal pressure without respiration. 3.4 cm. + with exhalation and 3 cm. — with inhalation.

Case X.—Nose broken four years ago. Watery discharge in both sides of the nose. Pain over the left frontal and in the occipital region. Obstruction of the left nasal passage. Radiographic findings negative. 2 cm. + without respiration, 5 cm. + with exhalation, and 3 cm. — during forced inhalation.

Case XI.—Obstruction in the nose now and then. Tinnitus with retracted drums. All turbinates slightly dilated. 0.5 cm. + when the needle was first introduced. 4 cm. + after five minutes. 2 cm. + with exhalation. 1.5 cm. — with inhalation. Radiographic findings negative.

Case XII.—Breathing difficult for two years. Much secretion in both sides. No headache. Septum with anterior deviation to the right. Radiographic findings showed both antra opaque. Left side closed by polypi. Left antrum 1 cm. + when the needle was first introduced; in six minutes the pressure fell to normal.

The remaining seven cases showed no negative pressure when there was no respiration.

It will be seen that in all cases which were apparently normal we found an average positive pressure of 1.17 cm. and in no case a negative pressure when respiration was at rest. In abnormal cases when air was not passing through the nose there was an average positive pressure of 1.53 cm. The average of the cases with obstruction was 0.36 cm. + more than that of the normal cases, with no negative pressure apparent. Of the normal cases but two had normal atmospheric pressure. These had especially large, roomy noses with fairly large antral openings, and no accessory openings could be demonstrated. The maximum pressure in the normal cases was 2 cm. + and in the abnormal cases 4.8 cm. +. The average change in the abnormal cases during respiration was only 0.95 cm. + for exhalation and 0.7 cm. — for inhalation. This average change was slightly less than in the normal cases, amounting to 0.2 cm. + with exhalation and 1.45 cm. — in inhalation. It was found, also, that there was a difference of 2.8 cm. + between the maximum pressure in the abnormal cases and the maximum pressure in the normal cases. The average respiration at rest in apparently normal noses was 1.176 cm. +. The average exhalation in apparently

normal noses was 0.8 cm. +. The average inhalation in apparently normal noses was 1.15 cm. —. The average respiration at rest in abnormal noses was 1.53 cm. +. The average exhalation in abnormal noses was 0.95 cm. +. The average inhalation in abnormal noses was 0.7 cm. —.

We found that when respiration was at rest the average pressure was 0.6 cm. + higher in the abnormal cases than in the normal; that the exhalation was 0.15 cm. + lower in the normal cases than in the abnormal; and that the inhalation was 0.45 cm. — more in the normal cases than in the abnormal.

Gording found that during forced exhalation through one-half of the nose there was a rise of 120 mm. Hg. Weider believed that long-continued, rapid, or violent breathing, producing headache, was a result of partial vacuum, which caused active congestion in the sinuses. Our findings did not bear out these facts, since in forced breathing when there was a negative pressure during inhalation we generally found, during exhalation, a corresponding positive pressure. It is obvious, as has been shown by our findings, that when the ostium is large and unobstructed the pressure is practically normal when breathing is at rest, but changes from plus to minus during respiration. It may seem strange that it is possible to have an obstructed ostium without a collection of secretion in the sinus, but probably the slight pressure caused by the obstruction not only checks the secretion of mucus but also causes it to be absorbed as soon as it is excreted from the glands. Our results showed that it was possible to have a marked obstruction of the sinus without a collection of mucus or pus. When there is infection in the sinus it probably occurs as a result of extension during colds, as we all know, and in the case of extension the pressure is not sufficient to overcome the extra secretion excited by the inflammation arising from the presence of bacteria. In several of the cases having obstruction we found normal pressure. This may be accounted for by the fact that in spite of the obstruction it did not happen to occlude the ostium.

While it is not within the scope of this paper to consider the causes of the various phenomena found during these experiments, we are tempted to enumerate such causes as suggest themselves.

Where the maxillary sinus is fairly large and the ostium is extremely small or occluded the amount of residual air is considerable. This air gradually becomes warmer from the heat of the body, which would make it many degrees warmer than air of a temperature of say 70° passing through the nose. Likewise this retained air would take up a percentage of moisture, which if the ostium were extremely small or obstructed would produce a slight pressure. Gases about the roots of defective teeth, sometimes discharging into the sinus, tend to increase the slight pressure already present, especially if there is a coexisting obstruction of the ostium with no accessory openings. Several cases have shown that the pocket formed, at times, back of the anterior tip of the middle turbinate seems to be an additional cause of increased pressure in the sinus. Since we did not find negative pressure in any of the maxillary sinuses when respiration was at rest, because of the close proximity of the openings, it seemed probable that much the same conditions existed in the frontal and anterior ethmoidal cells, provided they were not connected with the posterior ethmoidal cells. However, further investigation will be necessary to prove this. If negative pressure exists for any length of time in the maxillary sinus it must be a rather rare occurrence except during inspiration. That these findings have some practical bearing on a few obscure cases in which there is pain about the antrum would seem to be shown in the following two cases:

Case I.—W. E. W., aged thirty-one years; good health; dull pain under the eye, more or less constant for several weeks. Slight watery discharge from both sides of the nose. Radiographic findings show very slight or no opacity of the antra. Other sinuses and teeth negative. Right side of the nose turbinates red; anterior end of the middle turbinate dilated and pressing on lateral wall. Experimental puncture and transillumination negative. Pressure, 4.6 cm. +. Patient was etherized and an opening made on the right side under the inferior turbinate. Purposely we did not relieve the pressure in the region of the ostium. Since the relieving of the pressure the patient has had no further pain.

Case II.—Mrs. F. M., aged thirty years, had many severe headaches for several years. Unable to attend to social duties. Pain

under and sometimes over the right eye. No discharge anteriorly or posteriorly. Radiographic findings of sinuses negative, but first molar showed some evidence of absorption about the roots. Transillumination negative. Pressure, 6.2 cm. +. Anterior tip of the middle turbinate very large and pressing so firmly on the lateral wall that it was almost impossible to force a small probe between the lateral wall and the middle turbinate. Under cocain anesthesia the very large anterior tip was removed which contained a large cell. We purposely did not open the antrum. After reducing the pressure on the ostium we again took the pressure and found it had fallen to 1 cm. +. Pain relieved and there has been no recurrence.

These two cases would seem to show, beyond any reasonable doubt, that high atmospheric pressure in the maxillary sinuses was the cause of the pain, for in the first case the pressure was removed by opening the antrum under the inferior turbinate and in the second case the pressure was reduced by the escape of air through the ostium.

In no case, whether normal or abnormal, were we able to demonstrate any constant partial vacuum when respiration was at rest.

Positive pressure was the rule during exhalation except when the ostium was blocked.

Negative pressure was the rule during inhalation except when the ostium was blocked.

It is possible for marked positive pressure to exist without secretion or pus when the natural opening is obstructed. Symptoms of pain may result from positive pressure without the presence of liquid in the sinus if there is any obstruction of the ostium from any cause whatsoever.

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Gording: Serious Complications in the Puncture of the Maxillary Antrum. Investigations, by Experiments on Animals, of the Reflexes Produced from the Mucous Membrane of the Antrum. Air Emboli after Antrum Puncture.

# THE TONGUE AS A SOURCE OF SYSTEMIC INFECTION

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During the inquisitive wanderings of the tonsil lamp about the lymphoid coverings of the laryngopharynx, a year or so ago, our attention was attracted to the base of the tongue by the color signs in transillumination indicating the presence within the tissues of harbored material which is known to be capable of giving rise to systemic infection. As a more searching scrutiny but confirmed our growing belief that the tissues in question were of a similar character to those of the branches of the faucial tonsils, we were led by the seeming promise of further helpful revelations into a more or less careful study of the whole of the dorsum of the tongue.

The first glimpses of a new field of study or endeavor are, of necessity, caught somewhat out of focus and, therefore, a report of our early impressions of a rather inaccessible but seemingly rich field of infection must be regarded as of a preliminary nature. We also wish it to be understood at the outset that though we have made diligent efforts to penetrate some of the mysteries of the lymphoid tissues covering the base of the tongue, this study has, nevertheless, been made almost entirely from a clinical and not from a minute anatomical or morbid histological standpoint.

The subject of this communication is an old, old form over which we have but endeavored to drape a modernly shaped robe. Indeed, the especial features of it to which attention is particularly directed are perhaps the only ones which justify the presentation of this report—that the lymphoid structures on the base of the tongue, which in a general way are described in practically every text-book of anatomy and of diseases of the nose and throat, and also the white coating on the oral dorsum of the tongue, are common and at times prolific sources of systemic disorders produced by infection.

The aggregation of structural masses of lymphoid tissue on the base of the tongue should properly be spoken of as the lingual tonsil, for that body has been described as occasionally extending outward as far as the inferior poles of the faucial tonsils. It is our belief, however, that such an extension occurs in every case in which those tissues are developed beyond the normal state, and as the lingual tonsil is generally understood to mean a concrete, definitely outlined lymphoid body occupying the center of the base of the tongue, we will employ the term *lingual lymphoid apron* in referring to that area, because we do not doubt that, for at least this presentation, it will convey the clearest impression of the broad expanse of diseased tissues to be discussed in this paper.

The straight, clean-cut inner wall of an enucleated lingual branch of a faucial tonsil gave us the first clue to the existence of a juxtaposed layer of lymphoid tissue of only a little less thickness than the branch. Applying this knowledge to a series of studies with a tonsil lamp, of a size which would sink deeply into soft tissues, it was quickly revealed that in every one of the large number of adult subjects examined there was a layer of developed lymphoid tissue extending entirely across the base of the tongue between the borders formed by the lingual branches of the faucial tonsils. The thickness of this layer as measured by the tonsil lamp, and afterward verified by dissection, was found to vary in itself and in different subjects from about a sixteenth to a quarter of an inch or more. The cleared mysteries of a former tonsilloscopic study which disclosed the branches of the faucial tonsils and their numerous retention crypts, aided greatly in the exploitation of this, to us, new field, for the deduction seemed logical that as this tissue was manifestly lymphoid in character and gave the same tonsilloscopic color signs as those which accurately indicate the presence of filled retention crypts in the tonsil branches, the same reason for their production must necessarily exist in both. The reasoning proved to be correct, for the application of the means which were used in disclosing the crypts in the branches of the faucial tonsils, that is, a concentrated beam from a powerful lamp, a large warmed magnifying lens and a searcher, soon disclosed the presence of small mouths of crypts on the surface of this wide lymphoid field. The proof, however, that

they were openings of retention crypts was quickly forthcoming by the observed expulsion of exudate while pressure was being made with a curette close to the cryptic openings.

General Anatomy. When this area is viewed directly by deep depression of the tongue or indiretly in the laryngeal mirror, it appears in shape somewhat like a shield covering all that part of the tongue which, when the organ is at rest in the floor of the mouth, is out of the line of direct vision. The use of the ordinary tongue spatula will, as a rule, disclose only its upper margin, but a much better view of it can be obtained by drawing out the tongue. On closer inspection the surface of this lymphoid field suggests the appearance of an undulated plot of rough grass surrounded below and at the sides by a raised coping, the coping being the lingual branches of the faucial tonsils.

When viewed from behind (Fig. 1) the whole of this flat mass may be likened to a bat or butterfly with outstretched wings; that is, there is a narrow central section lying between two longitudinal creases, and outer or wing-like sections mounding up from the creases on either side. In the lower part of the central section is very frequently seen a concrete, more or less definitely outlined mass of the same character of tissue, which is the structure commonly spoken of as the lingual tonsil. As we now know that the lingual branches of the faucial tonsils are set into the outer edges of the lingual lymphoid apron as a piece is set into a picture puzzle, it is a fair inference that a similar sharply defined relationship will be found to exist between the central mass, which is usually regarded as the lingual tonsil, and the lateral areas or wings of the lymphoid apron. When the whole of the lingual blanket is thin and but little developed its surface presents a smooth appearance, but when it is well developed the lymphoid mass is thrown into heavy folds with contact creases between them which are capable of entrapping and retaining the secretions of the throat.

Crypts. The crypts of the lymphoid apron are quite numerous. Some of their openings are slits leading to pocket-like cavities with apposing walls. Even the tops of the circumvallate papillæ contain such pocket crypts. Many minute crypts open upon the floors of the creases. A great many more of the superficially

placed crypts are found in the border structure than elsewhere and some of them run under the surface like wall pockets. While many of the crypts are capable of retaining small quantities of the material which finds an exit through them, the amount so retained must certainly occasion far less mischief than the accumulation of exudate which is caught and more or less permanently retained by the contact creases in the apron and also by the entrapping papillæ on the dorsum of the tongue—which presently will be considered.

A network of superficially placed veins, in size somewhat corresponding to the degree of the lymphoid hypertrophy, is spread over the entire lingual blanket, and when the lymphoid tissue is fully developed the veins are more than likely to become the seat of varicosities.

White Coating of the Tongue. On the top of that portion of the tongue which, when the mouth is open, can be seen directly, are hundreds of small conical papillæ, each having a vasculo-nervous core, extending in lines parallel with the circumvallate papillæ from just in front of the circumvallæ to the edges and apex of the tongue. Back of those rows or lines and between them and the circumvallæ is a diamond-shaped area of irregularly placed conical papillæ of relatively large size, springing from a deeply folded surface, full of creases and sunken spaces, which makes it an especially commodious reservoir for retained secretions from the throat. And immediately back of the circumvallæ there is on each side a narrow field of the same variety of irregularly placed and relatively large-sized conical papillæ. According to Harrison Allen's *Human Anatomy*,[1] all of the conical papillæ are covered with hair-like extensions of epithelial cells; hence the name often given them of *filiform* papillæ. This cactus-like formation of the papillæ readily explains the presence on the surface of the top of the tongue of an apparently permanent layer of cheesy mould representing what is known as the white coating of the tongue, for the filiform extensions of the papillæ make the entire surface a veritable tanglefoot for the necrotic material worked up from the lymphoid apron, or which is deposited from other sources in the throat. This material is entrapped and enmeshed in the tangling filiform extensions and forms upon the top of each of the papillæ as a hood or cap of cheesy mould. These hoods of

foreign material become so closely incorporated with the tissues of the papillæ that they resist the friction of the passage of fluids and food and cannot be dislodged with a probe or even the edge of a blunt instrument. Indeed, they cannot be dislodged at all but must be shaved off as wax is shaved from the end of a candle. The top of the tongue is covered with a thousand of these small hoods, arranged in lines like strings of miniature pearls, which collectively form a thin layer of cheesy mould overspreading the entire surface. This thin layer constitutes the white coating, or "fur," of the tongue, and we now know that this coating is always of a pathogenic nature.

So we see that the lingual apron contains crypts and is a well-spring of exuding necrotic tissue. We also see that it provides many creases of varying depths which act as retention cavities. And we see still further that the surface of the top of the tongue provides traps for the entanglement and retention of the escaped contents of crypts as well as the ingesta of food in the mouth. The tongue is, therefore, seen to secrete necrotic material from the crypts of its apron, to afford reservoirs for the accumulated exudate in the creases of the apron and about the circumvallate papillæ, and also to afford storehouses for the same material on the tops of the numerous filiform papillæ.

While the "fur" on the tongue is not enclosed in crypts but lies spread out upon the surface, the bacteria, or their poisons, contained in it are apparently as capable of finding their way to remote parts to produce infection as those within its feeder—the lymphoid apron. It must, however, be said that the pathogenic bacteria in the necrotic material on and in the tongue are as a rule fewer in number than those found in the foreign material recovered from the deep recesses of the faucial tonsils, but the question of relative pathogenicity has yet to be determined.

It has long been the custom to regard the white coating of the tongue as a diagnostic sign of certain digestive disorders or as pertaining to general states of the health. That it is an effect of indigestion seems to have been repeatedly disproved by the relief of many symptoms of indigestion through the removal of the coating and the exudate from the apron. A white coating on the tongue would, therefore, seem to indicate the presence in that

locality of a cause and not an effect of at least chronic systemic diseases, and even though our observations have been limited to a hundred and twenty cases, we, nevertheless, believe it to be safe teaching to say that except in febrile states a uniformly white "furred" tongue may be regarded as a reliable indication of the existence of a diseased condition of the lingual lymphoid apron, and that the extent and density of the "fur" is a fairly accurate indicator of the extent of disease in the lymphoid tissue on the base of the tongue.

When a broad field of lingual exudate has been long exposed to the air it occasionally undergoes putrefactive changes and gives rise to an offensive breath. Of course, this is not the only area in which cryptic secretions become putrid and give offence, but we have repeatedly been able to prove that the source may be entirely confined to this particular region by cleaning the tongue exclusively, with the result of extinguishing the odor.

Character of Exudate and Bacteria. The exudate recovered from the crypts and retention pockets of the apron and also that which is shaved from the surface of the dorsum of the tongue is almost invariably of a cheesy character. Occasionally it appears much like mucopus with flocculæ of cheesy matter floating in it, but in almost every case it has either the appearance of pus, thin cream, fresh white paint, half-melted ice-cream or cream cheese. We have removed such material from the crypts of the apron and the surface of the oral dorsum of the tongue in about one hundred and twenty subjects, varying in age from eight to eighty years. Most of them were patients in our private practice who had sought relief from symptoms which were believed to be due to infection. Some of them, however, were devoid of symptoms but placed themselves at our disposal solely for the purpose of supplying data for a scientific test. Characteristic necrotic material was recovered from the apron and the top of the tongue in every one of the subjects, and each collection yielded a pathogene on culture. The Staphylococcus pyogenes aureus, or albus, was present in every culture, and the hemolytic streptococcus, the Streptococcus viridans or the pneumococcus in about 20 per cent of the cases. In a number of the cultures bacilli of Vincent's angina also were present. These facts were obtained from a

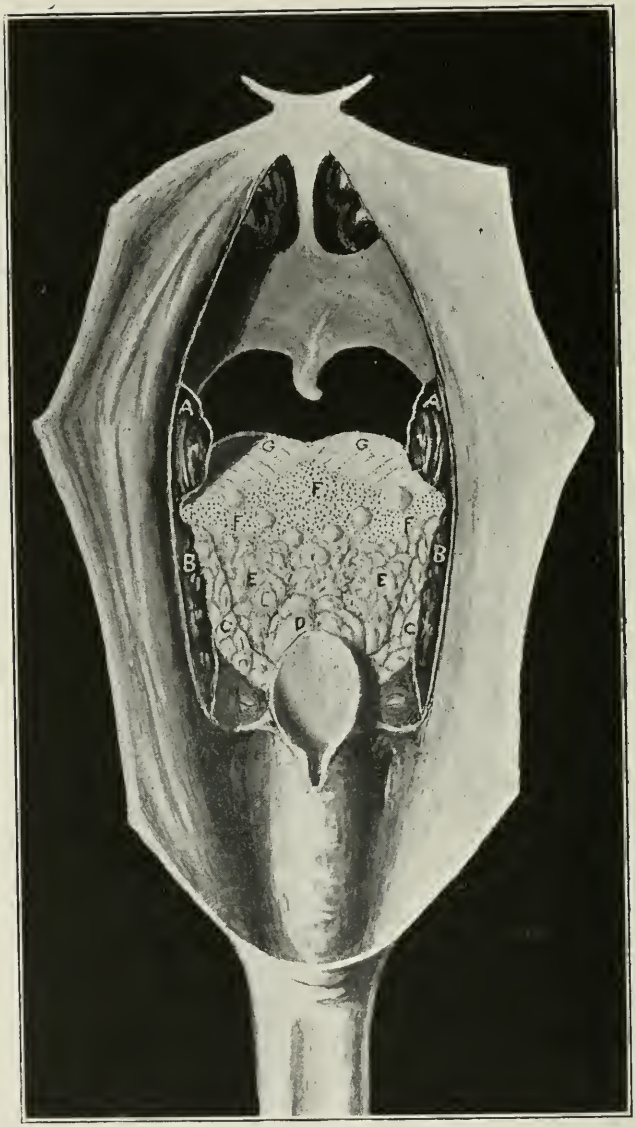


FIG. 1.—Diagrammatic drawing of the pharynx as it would appear if laid open and viewed from the back of the neck. *A.A.*, faucial tonsils, *B.B.*, pharyngeal branches of the faucial tonsils; *C.C.*, lingual branches of the faucial tonsils; *D.*, lingual tonsil; *E.E.*, blanket of lymphoid tissue which together with the lingual tonsil and the lingual branches of the faucial tonsils constitute the lymphoid apron on the base of the tongue; *F.F.F.*, dotted area showing irregularly placed large filiform papillæ in front of and behind the circumvallate papillæ; *G.G.*, filiform papillæ in oblique lines on the oral dorsum of the tongue; *F.F.F.* and *G.G.*, show the areas of the white coating of the tongue.

group of subjects which was not selective and must, therefore, be regarded as at least significant of the extent to which this infective condition prevails in the human family.

Possible Removal of Lingual Branches. A study of enucleated lingual branches of the faucial tonsils shows that they are provided with well-developed underlying capsules and also that these border structures are set up against the edges of the apron as sharply as tiles are set against other tiles in cement. This knowledge affords excellent reasons for believing that the whole of the apron has beneath it a limiting membrane or capsule which would make possible its complete removal from the tongue and so permanently dispose of its numerous collections of baneful bacteria. Unless, however, accidental stripping of this structure from the tongue should demonstrate the feasibility of dispensing with such a protective layer and that subsequent dryness would not occasion perpetual distress to the patient, as we fancy it would, we doubt if a radical disposal of the whole of that wide lymphoid blanket should at present be seriously considered. We are not yet in a position to express an opinion of the effect in dryness of the enucleation of the lingual branches of the faucial tonsils which form the border of the apron, but we believe it highly probable that as those structures are the greatest offenders by containing the largest number of crypts, we will soon be able to feel our way to a decision in this important matter.

Curettage. Very happily, however, the conservative method of curettage is admirably adapted to the removal of the contents of the crypts and pockets in this situation, as well as to the removal of the white coating of the tongue. As the lymphoid apron is a broad veneer of yielding tissue of practically uniform thickness, lying flat upon the muscular structure of the base of the tongue, it lends itself far better to exploitation, evacuation and surface cleaning by curettage than do any of the other lymphoid or other tissues in the pharynx. Though the ordinary curettes failed to meet the need, the sideway sweeps of their shanks soon revealed the paths which must be followed to secure the release of the trapped detritus. The way being pointed out we applied the edge of a bent sharp submucous resection elevator, pressed it firmly into the soft lymphoid blanket and drew it obliquely upward, with the

pleasing result of rolling the necrotic material up upon the flat of the blade as snow is rolled up upon the board of a snow-scraper. The *lingual plane*, which was evolved from the sharp elevator and is now being used (Fig. 2), differs from the early models in that the inner flat surfaces are laid back at angles of 30° and 40°, the end is curved at a slightly acute angle and the shank is bent to fit over the tongue.

To this instrument every lingual apron to which it has been applied has quickly yielded varying quantities of necrotic material, and not uncommonly when the accumulated results of the shavings of the dorsum of the tongue are added, the quantity in a seance amounts to a cubic centimeter or more. Following the movements of the plane in the image of the lingual field reflected in the laryngeal mirror, gives by far the best results. Without the mirror the nodular eminences alone are scraped and perhaps injured and the creases in which much of the broken-down material lies are left untouched.

Fig. 2.—The lingual plane.

As both hands of the operator are fully occupied in the procedure about to be described, the tongue must meanwhile be held out by the patient. Then, after a surface application of a 4 per cent solution of cocaine to the apron only, followed by the irrigation of the whole length of the tongue with a 50 per cent solution of alcohol, the plane is passed down over the left side of the mound of the tongue, and while its edge is being pressed firmly into the border of the apron it is swept for a half-inch or so toward the opposite side of the throat. The instrument is then drawn forward and out of the mouth, gathering on its way the material which was expressed and dislodged from the section it had covered. The collections adhere to the plane until scraped off over the edge of a tongue spatula. The remainder of the apron should then be curetted by repetitions of the movements just described until it

is felt that the whole of the lingual blanket has been covered. Around the median raphe, for an inch or so in front of the lines of the circumvallæ, the filiform papillæ are larger and are covered with hoods of foreign matter which are so much thicker than those upon the neighboring papillæ that they coalesce to make a broad and almost solid patch of cheesy mould which, in especially large quantities, can readily be removed from the soggy surface. While the patient continues to hold out the tongue, the lingual plane should next and finally be swept over the oral dorsum of the tongue from the anterior edge of the apron forward toward the tip, by a series of sweeps which perhaps can best be compared to the action of a dull drawplane in removing bark from a seasoned log, or of a lawn mower over a level plot of grass, except, of course, that the plane does not actually cut the living tissues. As in addition to the cheesy hoods of the papillæ the shaving plane must in this region gather up a considerable quantity of buccal secretions overlying the coating of "fur," it is often most convenient to hold the side of a spoon against the dorsum of the tongue, near its tip, to act as a runway depository for the copious collections.

While a dull plane will remove much of the necrotic material from the apron, and is the safest to use in that area, it will have but little effect upon the coating of the tongue. A plane which is too sharp will injure the tissues and excite reactions. A plane which, however, is just sharp enough will shave the hoods of mould, together with their filiform traps, from the tops of the papillæ without injuring the tissues. This, however, can only be accomplished by repeatedly drawing the plane over the surface of the tongue as a carpenter's plane is drawn over the surface of a board. If an attempt is made to carry out this procedure thoroughly in one seance, a reaction of myositic pain in various parts of the body is very apt to follow and continue for a day or two. It is, therefore, best to proceed slowly, but, nevertheless, to persist in ridding the surface of the dorsum of the tongue of its original pathogenic coating, for it is now manifest that the original coating down to the tops of the papillæ must, as nearly as possible, be removed in order to permanently eliminate a source of infection from the tongue. It is somewhat difficult to shave the hoods from the papillæ just back of the circumvallæ without injuring those larger and firmer

structures and, therefore, the effort should always be made with the aid of the mirror. Patients rarely experience even the slightest local discomfort after the proper employment of the lingual plane.

Before and after curettage, and between the seances at home, the use of alcohol in from 40 per cent to 50 per cent solutions as a mouth wash will assist in cleansing the surfaces and in destroying the bacterial content of the cheesy mantle lying in or upon the dorsum of the whole length of the tongue.

Reactions. There could, perhaps, be no more direct and easily demonstrated evidence of the pathogenicity of the exudate which is found in and upon the tongue and of its capabilitity of exciting toxic systemic disturbances, than the reactions which very commonly occur almost immediately after the performance of lingual curettage. While such reactions have been most pronounced after the removal of large amounts of detritus from the tongues of subjects whose cultures showed the presence of great numbers of the most virulent forms of microörganisms, they also have occurred, at times with most unpleasant emphasis, in subjects whose cultures grew only a few of the weaker forms of pathogenic bacteria.

The character of the reaction which usually occurs in subjects suffering from myositis is an increase of pain for a few hours, or even days, which is usually confined to or is most pronounced in or about the seat of the disturbance for which relief is sought. The pain of reaction may, however, extend into other parts or even occur in various other localities. In arthritic subjects the commonest form of reaction has been a general sense of discomfort and uneasiness for a day or two or an increase of pain in the affected part. In the subjects of gastrointestinal disorders the reaction has most often taken the form of nausea, or even vomiting, but occasionally there has been a brief attack of diarrhea with cramps. In subjects without symptoms, who had submitted to the treatment to assist in the scientific test, myositic pains occasionally occurred after the removal only of the coating of the tongue, but in the large majority of every kind of cases, even after the removal of great quantities of necrotic material from the whole of the tongue at one time, reactions either have not occurred at all or have taken the form of slight malaise in the night and on the day following a seance of curettage.

While it may not be possible to prevent entirely the occurrence of reactions after curettage, they, nevertheless, can be ameliorated or avoided by taking pains to prevent injury to the epithelial layer through guidance of the movements of the plane in the mirror, or, by removing a smaller quantity of detritus, especially in the early seances, or, by making the interval between the seances at least a week, or even ten days, or by all of those measures combined. The testimony of a number of intelligent and observant individuals in whom severe reactions had occurred was to the effect that the severity of the symptoms of their reactions progressively declined, and in some cases disappeared, during the course of the treatment.

Decline of Virulence of Microörganisms. This opens the way to record an expression of belief borne of a long experience with curettage of all of the lymphoid structures of the pharynx, excepting the pharyngeal tonsil, that the original necrotic tissue which may have occupied the trapped surface of the oral dorsum of the tongue or which has been sheltered within the crypts, pockets and creases of the lymphoid apron for a long period of time, is empowered with greater virulence than that which is reproduced after the removal of such original material. Necrotic tissue will invariably be reproduced if the entrapping filiform extensions of the papillæ on the dorsum and the crypts and creases of the apron remain intact, but, apparently, for a time at least, though from other sources, we have known it to be for years, its infective power is weakened or abolished, or the body is immune to it.

Since we have been made aware of the potentialities lurking in the contents of the tonsillar branches and the lymphoid apron, as well as in the layer of pathogenic exudate lying upon the top of the tongue, we have had numerous opportunities to try out the effects of curettage of all those structures in adult subjects from whom the faucial tonsils had been removed, and the often marked improvement in or abolition of persisting symptoms secured in that way have clearly shown that to relieve human suffering produced by infection from the throat we must be prepared to deal with a much larger field than that comprised within the faucial tonsils only.

Infections. The diseased tongue seems mainly to be an expansion of the oral and pharyngeal fields which act as sources of systemic infection, and while our experiences have shown very plainly and positively that it holds an especially intimate causal relationship with disorders of the digestive tract, we have been able, in addition, to clearly demonstrate it to be a contributive factor in, or the sole reason for, the occurrence of myositis, rheumatism, arthritis, vasomotor rhinitis, inflammatory new growths, reflex cough, enlarged thyroid glands, pendulous folds under the chin, some of the simpler forms of skin diseases, low and high blood-pressure and arrhythmia.

An instructive demonstration of the effects of the removal of the necrotic contents of the lingual apron and the layer of coating of the tongue upon chronic rheumatism was given in the case of a physician who had suffered for eighteen months with severely painful and crippling rheumatism of the back. Every known means of relief had been contributed by many of his confrères without success before he was referred by an orthopedic surgeon for curettage of the tongue. The pain began to yield after the eighth or ninth seance, each one of the curettage procedures having been followed by progressively decreasing reactions of pain in the affected region, and now the patient, who is desirous of having this report published, says that he is only rarely reminded that he has a back. The predominating organism in this case was the Staphylococcus aureus in large numbers.

The list of disorders given above must serve only as a suggestive pointer, for we have been too much occupied in an effort to determine the infectivity of the necrotic tissue taken from diseased tongues to attempt to apply the test to the relief of any other maladies than those which fell incidentally under our observation and care during the course of this investigation.

During the period in which the relation of this field to various systemic conditions was being tried out, practically every patient whose lymphoid apron had been largely cleared of its diseased contents and whose tongue coating had been repeatedly shaved off, expressed their consciousness of a refreshment in their general health; that their appetite was better; that there had been an

increase in weight, if before the treatment it had been below normal, or that they had more vigor and endurance and could accomplish more than usual—and their appearance often bore eloquent testimony to the truth of their assertions.

Evidences of immediate improvement rarely follow curettage of the apron and the white coating of the tongue. It seems to be necessary in almost every case to remove by repeated scrapings of the entire tongue most of the original exudate before improvements begin to be recognized. If then the results are not shown in any special way they are quite certain to appear in the form of improvements in general health. And our belief is that such improvements in health are almost always and almost entirely due to improvements in the digestive function. Indeed, so much of impressive evidence has been presented of pronounced amelioration in or complete disappearance of various and often distressing symptoms of chronic indigestion during or after the course of treatment by curettage, that there is now no room left for doubt that a very intimate causal relationship through infection exists between the diseased tongue and the gastrointestinal tract. In other words, this area apparently holds the key to many of the still unsolved mysteries concealed within chronic disorders of the alimentary canal.

In commenting upon the association of gastrointestinal disturbances with lingual tonsil hypertrophy, Wright and Smith[2] record a keen observation which in the light of recent revelations seems singularly like a prophecy. They write: "Chronic dyspepsia of the nervous type is observed in a considerable number of patients. Constipation is another condition which is apt to be associated with lingual hypertrophy. Whether the close relationship in anatomy and function with the gastrointestinal tract has any influence in the association of acid dyspepsia and constipation and lingual tonsil symptoms we do not presume to say, but we call attention to the suggestiveness of the coincidence."

That the necrotic tissue in and on the tongue is at times the sole cause of chronic constipation by infection has been conclusively demonstrated in a number of cases during this investigation. The following is a graphic illustrative case:

Case.—M. C., female, aged twenty-four years, whose tonsils were well enucleated five years ago, had suffered severely and continuously from constipation since she was twelve years of age. No apparent result followed six or eight seances of curettage of the lingual apron except a rather sharp reaction in the form of diarrhea, but almost immediately after the surface of the dorsum of the tongue in front of the apron had been included in the curettage procedure, three months ago, the bowels began to move without artificial assistance. After two or three subsequent shavings of the white coating of the tongue, the movements, for the first time in half the years of her life, became quite normal, and daily natural evacuations have continued up to the time of this writing. Meanwhile her appetite has quickened and thirty-two pounds have been added to her weight. Incidentally it may be of interest to note that what curettage of the diseased tissues of the tongue has done for this patient's constipation it also has done for her long-standing extreme dysmenorrhea.

The above story, in almost its exact language, could be made to apply to another case in which, however, our efforts were aimed solely at the relief of an infection of quite a different nature.

We are fully aware that the observations recorded in this report represent only a very few of the facts which ultimately will be revealed in this practically untilled field of almost limitless possibilities, but, nevertheless, the amount of evidence thus far accumulated seems to be sufficient to offer an ever-brightening promise that while the elimination of the exudates from the almost universally infected tongue may extend the length of the lease of life, it will also, quite certainly, ensure that which is far more to be desired—an increase in the reserves of health.

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# LARYNGEAL PARALYSIS ASSOCIATED WITH THE JUGULAR FORAMEN SYNDROME AND OTHER SYNDROMES

*Candidate's Thesis*

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Complete unilateral paralysis of the recurrent laryngeal nerve is not uncommon and is usually due to aortic aneurysm, carcinoma of the esophagus or pressure on the nerve from some type of neoplasm.

Jackson, in 1864, first described complete unilateral laryngeal paralysis associated with paralysis of the soft palate, tongue, trapezius and the sternocleidomastoid muscles. Since the lesion occurs in the region of the jugular foramen, where the ninth, tenth and eleventh cranial nerves leave the skull, and the hypoglossal foramen, through which the hypoglossal nerve passes, the syndrome has been called the jugular foramen syndrome of Jackson. Jackson's original description does not contain details with regard to the involvement of the ninth cranial nerve, as shown by the change in the sensation of taste on the posterior part of the tongue and by involvement of the pharynx.

Mackenzie, in 1883, reported a patient with a syphilitic lesion of, or near the medulla, causing paralysis of the soft palate, tongue, vocal cord and the sternocleidomastoid and trapezius muscles. The patient did not respond to treatment for syphilis. He had constant headache and vomited occasionally. A swelling of nine months' duration involved the left side of the soft palate and the tonsil and displaced the uvula to the right. It is possible that this patient had a nasopharyngeal tumor with secondary affection of the jugular foramen and intracranial involvement. In discussing Jackson's case at the Harvaine Society in 1886, Mackenzie said that he had seen eight

patients with unilateral paralysis of the tongue, soft palate and vocal cords.

Collet, in 1915, reported a case of what he called "the total syndrome," in which the ninth, eleventh and twelfth cranial nerves were affected. The patient was a soldier who had received a bullet wound in the right mastoid region. He complained of difficulty in swallowing and deafness and noises in the ear. The roentgen ray showed a shrapnel ball situated at the base of the skull. There was hemiplegia of the tongue, larynx, palate, pharynx and of the sternocleidomastoid and trapezius muscles, and lack of perception of taste at the base of the tongue on the side involved.

Avellis, Schmidt and Tapis have reported syndromes associated with laryngeal paralysis in which certain variations have occurred. Avellis reported paralysis of the tenth cranial nerve, Schmidt of the tenth and eleventh nerves and Tapia of the eleventh and twelfth.

Lannois and Vernet reported two cases of war wounds; in one the bullet entered the malar region and in the other it entered the preauricular region. In both cases the ninth, tenth, eleventh and twelfth nerves were affected, and in the second case the cervical sympathetic as well.

Lannois and Jouty reported a case of a soldier injured back of the angle of the jaw; the last four cranial nerves were affected. These authors found that seventeen instances of the jugular foramen syndrome had been reported.

Vernet reported a case in which a soldier was injured by a shell fragment passing through the external auditory canal. Roentgenograms revealed the fragment in the prevertebral region. Besides the total syndrome the seventh nerve on the injured side was paralyzed by the wound.

Hall, in a consideration of the etiology of unilateral paralysis of the recurrent laryngeal nerve, collected 116 cases and found that in 10, besides the laryngeal paralysis, there were hemiplegia, paralysis of the face, palate, pharynx and the trapezius and sternocleidomastoid muscles.

Thomson, in an analysis of the 360 cases of unilateral paralysis of the larynx, found one in which symptoms were due to an extracranial growth close to the exit of the vagus.

TABLE I.—SUMMARY OF CASES

| Case. | Age, sex. | Duration. | Cause. | Primary nasopharyngeal tumor. | Secondary nasopharyngeal tumor. | Cranial nerves. | | | | | | | | | | Cervical sympathetic nerve. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Second. | Third. | Fourth. | Fifth. | Sixth. | Seventh. | Ninth. | Tenth. | Eleventh. | Twelfth. | |
| A81249 | 62 F. | 3 yrs. | Indeterminate, neoplasm (?) | ... | ... | .. | .. | .. | .. | .. | .. | .. | + | + | + | |
| A165869 | 52 M. | 8 yrs. | Epithelioma | ... | + | .. | + | + | + | + | + | +(?) | + | + | + | |
| A271166 | 47 M. | 6 wks. | Neoplasm (lymphosarcoma?) | + and pharynx | ... | .. | .. | .. | .. | .. | .. | +(?) | + | + | + | + |
| A285410 | 35 M. | 2 yrs. | Carcinoma (mixed tumor type) | ... | ... | .. | .. | .. | .. | .. | .. | + | + | + | + | + |
| A348444 | 43 F. | 12 yrs. | Neoplasm (mixed tumor type?) | ... | ... | .. | .. | .. | .. | .. | .. | + | + | .. | + | + |
| A350568 | 54 F. | 3 mos. | Neoplasm (lymphosarcoma?) | + | ... | + | + | + | + | + | .. | + | + | + | + | + larynx not involved. |
| A361632 | 40 F. | 4 yrs. | Neoplasm (mixed tumor type?) | ... | ... | .. | .. | .. | .. | .. | .. | + | + | + | + | |

Guder and Dufour reported 63 cases of unilateral paralysis of the recurrent laryngeal nerve, but none was associated with the jugular foramen syndrome.

Aloin reported a case of acute phlegmon of the pharynx and neck; the patient developed paralysis of the soft palate, vocal cord and tongue, with weakening of the shoulder muscles, due to neuritis of the tenth, eleventh and twelfth cranial nerves. He noted that involvement of the tenth nerve was shown by intense salivation, pulse 140 and difficulty in breathing, not accounted for by any mechanical cause. Several months passed before the paralyzed muscles returned to normal.

Cauzard and Laignel-Lavistine reported a syphilitic lesion of the right bulb with involvement of the fifth, seventh, ninth, tenth, eleventh and twelfth cranial nerves.

Beck and Hassin reported a case of tuberculosis of the cervical glands and secondary invasion of the ninth, tenth, eleventh and twelfth nerves. The symptoms improved markedly following removal of the glands. The symptoms recurred and a second operation was performed to free the nerve from the scar tissue.

Pollock reported a similar case in a man in whom the last four cranial nerves and cervical sympathetic nerves were affected, owing to tuberculous adenitis. There was no change in pulse, respiration, secretion or sensation.

It is seen that many varieties of symptoms may result from involvement of the last four cranial nerves in the region of the jugular foramen.

Bourchart reported the involvement of the cervical sympathetic nerve associated with laryngeal paralysis.

Vernet gives a complete table showing the effect of paralysis of the ninth, tenth, eleventh and the twelfth cranial nerves. What he considers the internal branch of the eleventh nerves is usually classified in this country as part of the tenth. This, however, is a matter of nomenclature. The distribution of the ninth and tenth nerves, as seen in Table II, is not absolute. The affection of the cervical sympathetic nerve is shown by myosis, narrowing of the palpebral fissure and enophthalmos.

TABLE II

| | Vernet. | Oppenheim. |
|---|---|---|
| Paralysis of the ninth | Paralysis of the superior constrictor of the pharynx (curtain movement of the posterior wall, disturbances in deglutition of solids); disorders in taste, posterior one-third of the tongue. | Loss of taste over the posterior part of the tongue; difficulty in swallowing owing to paralysis of some of the pharyngeal muscles; abolition of reflex excitability of the pharyngeal mucosa. |
| Paralysis of the tenth | Disorders in sensibility of half of the soft palate, of the pharynx, of the larynx, of the auricular branch; disorders of salivation; coughing crises; disorders of respiration (intermittent dyspnea and pseudo-asthma). | Unilateral paralysis of the palate, pharynx, larynx; anesthesia of the pharynx, larynx and external auditory meatus rarely found; sometimes slowing, sometimes acceleration (irregularity) of breathing; heart symptoms not constant: sometimes slowing but most often acceleration. |
| Paralysis of the eleventh | Internal branch: Paralysis of half of the soft palate and larynx; acceleration of the pulse. External branch: Paralysis of the sternocleidomastoid and trapezius muscles. | Paralysis of the sternocleidomastoid and trapezius muscles. |
| Paralysis of the twelfth | Hemiparesis of the tongue. | Hemiparesis of the tongue. |

REPORT OF SEVEN CASES OBSERVED IN THE MAYO CLINIC

Case I (A81249).—Mrs. T. J. D., aged sixty-two years, came to the Clinic, June 29, 1921. She had had two operations for exophthalmic goiter, February 3, 1914, and January 6, 1915, respectively. For the last two or three years she had noticed shrinking and weakness of the right side of the tongue. The last nine months she had had hoarseness and breaking of the voice, difficulty in swallowing, regurgitation of food, breathlessness on exertion and pronounced tachycardia and palpitation. She had had pain in the left arm for three or four months.

Examination revealed the middle line of the palate displaced to the left and partial paralysis of the right side of the palate. The right side of the tongue was atrophied and protruded to the right. The right vocal cord was fixed in the intermediate or cadaveric position. No pathologic changes were demonstrable in the nasopharynx, nor was change in sensation demonstrable in the pharynx or larynx. The right sternocleidomastoid and trapezius muscles were partially paralyzed and atrophied.

*Summary.* In this case the tenth, eleventh and twelfth nerves on the right side were partially affected. The etiologic factor was questionable, but the condition was probably due to a neoplasm in the region of the jugular foramen.

Case II (A165869).—Mr. H. N., aged fifty-two years, came to the Clinic, July 13, 1921, because of recurring epithelioma of the right cheek. He had had syphilis thirty years before. When a child he had been injured on the right cheek at the site of the present lesion. The area had remained discolored until twelve years before, when a sore had developed. In 1918 this area was plastered by a cancer quack. In 1920 it was excised; roentgen-ray treatments had been carried out four months before; the cheek had been cauterized and medicinal treatment given by the local physician one week before.

Examination showed a recently cauterized opening in the right cheek just below the malar bone, 3.75 cm. in diameter and 2.5 cm. deep. A specimen removed from the margin revealed basal-cell epithelioma. The Wassermann reaction was strongly positive, amounting to total inhibition.

July 20, 1916, the area on the right cheek was thoroughly cauterized with soldering irons and treatment for syphilis instituted.

The patient returned June 6, 1919, complaining of diplopia and pain over the right side of the head. Examination showed paralysis of the right external rectus muscle and involvement of the fifth nerve. August 8, 1919, almost complete paralysis of the right fourth, fifth and sixth nerves had developed.

February 24, 1921, the patient returned and requested a plastic closure of the opening in the right cheek, about 5 cm. in diameter, which connected the nose, the antrum and the mouth. Since our last examination, August, 1919, two operations had been done elsewhere, one fifteen months before and one twelve months before. The right eye had been removed with the orbital growth and a plastic operation attempted. Examination then showed a recurring basal-cell epithelioma at the right margin of the orbit. The left eye was normal, the fundus negative and vision 6/6. There was a definite fulness in the right nasopharynx. The small recurrent growth was removed and treatment for syphilis was given.

December 27, 1921, the patient returned complaining of pain on the right side of the head, hoarseness and difficulty in swallowing. The right side of the soft palate and pharynx was paralyzed and the right cord was fixed in a cadaveric position. There was diminished sensation over the right side of the pharynx and a collection of mucus in

the hypopharynx. There was paralysis of the right sternocleidomastoid and trapezius muscles. The right nasopharynx was filled with a sloughing area, malignant in appearance. The patient was deaf in the right ear, owing to involvement of the nasopharynx. There was complete facial paralysis on the right, with areas of anesthesia on the affected side.

Roentgenograms of the skull were negative; examination of the left fundus was negative. The pulse was 88 and there was no respiratory trouble. Examination showed involvement of the fifth, seventh, ninth, tenth, eleventh and twelfth cranial nerves.

*Summary.* The right third, fourth, fifth, sixth, seventh, ninth (?), tenth, eleventh and twelfth cranial nerves were affected, owing to direct extension from an epithelioma of the cheek to the region of the jugular foramen and possible extension intracranially.

Case III (A281166).—Mr. M. F. M., aged forty-seven years, came to the Clinic, February 2, 1921. Six weeks before the patient had had pain over the right mastoid region and had noticed something wrong with his throat, which seemed sore. His home physician had lanced it, expecting to find an abscess, but no pus was found. Pain in the right ear had been accompanied by slight deafness. The patient had been unable to swallow for a week, as fluids strangled him and regurgitated into his nose. He had lost seventeen pounds in weight in the last six weeks.

Examination showed drooping of the right upper eyelid and a small right pupil. A nonulcerating mass in the right side of the nasopharynx extended into the pharynx and partially into the hypopharynx. Metastatic glands were present at the right angle of the jaw. The muscles on the right side of the palate were paralyzed. There was a great deal of mucus in the right pyriform fossa and the right cord was fixed in the intermediate or cadaveric position. The right side of the larynx was somewhat insensitive and paralysis of the muscles of the right side of the pharynx and of the sternocleidomastoid and trapezius muscles was noted. The tongue protruded to the right. There were no respiratory or cardiac disorders. The ninth, tenth, eleventh and twelfth nerves were affected by the nasopharyngeal and the pharyngeal tumor.

*Summary.* This patient presented a rapidly growing tumor, probably lymphosarcoma, of the right nasopharynx and pharynx, and affecting the ninth (?), tenth, eleventh and twelfth nerves and the cervical sympathetic nerve.

Case IV (A285410).—Mr. A. W., aged thirty-five years, came to the Clinic, August 29, 1919, on account of roaring and pain in the right ear. A year before he had become deaf. Since then he had had attacks of sharp pains in the right ear which had lasted only a few minutes. There was no discharge from the ear, but about one year ago a small tumor had appeared below it. The patient's general health was good.

Examination revealed a small, rounded, pedunculated tumor on the floor of the right auditory canal, 1.5 mm. in diameter, and a tumor in the right parotid region just posterior to the ascending ramus of the jaw, which was about 3.75 cm. in diameter and "felt" malignant. The tumor in the auditory canal was removed, but malignancy was not demonstrable microscopically. The ear-drum was normal. A roentgenogram of the skull was negative and the neurologic examination afforded nothing of note. September 3, 1919, the mass in the parotid region was explored by Dr. Sistrunk, but the tissue removed did not show malignancy.

The patient returned October 21, 1920, complaining of loss in weight, hoarseness, and difficulty in swallowing, of eight weeks' duration. He had pain lasting for a few minutes at a time in the right shoulder and right side of the neck. The right cord was fixed in the cadaveric position with a collection of mucus in the pyriform fossa. Paralysis of the soft palate, pharynx and vocal cord was complete on the right side. Neither edema nor neoplasm was visible. The tumor below the right ear in the parotid region was still present. The sternocleidomastoid and trapezius muscles were partially paralyzed. The ninth, tenth, eleventh and twelfth cranial nerves were affected, due to a tumor arising in the right parotid region and extending to the jugular foramen.

November 13, 1920, Dr. Adson explored the area and found a carcinoma of the mixed-tumor type, 3 cm. in diameter and 17.5 cm. in length, situated in the region of the jugular foramen outside of the skull with some extension into the cranial cavity through the foramen. The tumor was removed. The patient recovered uneventfully, but with no change in the nerve, as had been expected.

*Summary.* In this case the tumor was a carcinoma of the mixed-tumor type in the right parotid region. The carcinoma involved the jugular foramen extracranially and the ninth, tenth, eleventh and twelfth cranial nerves.

Case V (A348444).—Mrs. W. B., aged forty-two years, came to the Clinic, February 3, 1921. She complained of weakness, hoarse-

ness, choking sensation and drooping of the right eyelid of about two years' duration. When swallowing she had noticed a choking sensation in the throat, and coughing had brought food back into her mouth. Sixteen months before she had noticed that the right side of her tongue was thick and stiff. When eating she had perspired freely over the right side of the face and scalp, so that drops of water fell to her shoulder. Her heart had palpitated at times and she had had become dyspneic when climbing stairs. She had lost thirty-two pounds in weight, ten during the last month.

Examination revealed a very slight ptosis of the right upper eyelid; the right pupil was myotic. Vision was normal. Examination of the nasopharynx was negative. The right half of the tongue, the right side of the soft palate and all of the pharyngeal muscles were paralyzed and atrophied. The right vocal cord was fixed in an intermediate position. There was marked anesthesia over the soft palate, the right pharynx and the larynx. The sternocleidomastoid and trapezius muscles were not paralyzed. A firm mass, 3.5 cm. in diameter, was found between the right angle of the jaw and the mastoid process. Examination of the heart revealed a loud systolic murmur, heard best at the apex and transmitted to the axilla. Anemia was marked. The hemoglobin was 30 per cent, the erythrocytes numbered 3,170,000 and the leukocytes 5800. The color index was 0.4; polynuclear neutrophils, 67.5; small lymphocytes, 27.5; large lymphocytes, 4.5; basophils, 0.5; anisocytosis and poikilocytosis were slight.

*Summary.* This case illustrates involvement of the ninth, tenth and twelfth cranial nerves and possibly partial involvement of the cervical sympathetic nerve by a mixed tumor in the region of the jugular foramen.

Case VI (A350568).—Mrs. F. O. B., aged fifty-four years, came to the Clinic, February 25, 1921. Three months before she had noticed pain above and behind the right eye and deafness in the right ear. Two months before, she had had difficulty in opening the mouth wide; a swelling had appeared on the right side of the face and the right nostril had become obstructed. Three weeks before, the corner of the mouth and the upper eyelid on the right side had begun to droop. Two weeks before, she had noticed that she could not move the right eye; it became more prominent and blindness developed gradually.

The general examination showed nothing of note. Examination of the eyes revealed a proptosis of the right with drooping of the upper eyelid, complete ophthalmoplegia and blurring of the disk. Pupillary

reflexes were absent; the right pupil was dilated. Vision of the right eye was 0, of the left 6/4. There was bulging of the right temporal region. A tumor, ulcerated and bulging to the middle line, filled the right side of the nasopharynx. The Eustachian tube could not be seen. The right side of the palate and pharynx was paralyzed. The tongue deviated to the right. There was no laryngeal paralysis. Sensation was decreased over the right cheek, the forehead and chin, and the action of the muscles of mastication was impaired. The trapezius and the sternocleidomastoid muscles were not paralyzed. Deafness was complete in the right ear.

*Summary.* This case illustrates involvement of the third, fourth, fifth, sixth, ninth, tenth and twelfth cranial nerves and probably the cervical sympathetic nerve by a rapidly growing nasopharyngeal tumor, probably lymphosarcoma. The deafness was owing to encroachment of the tumor on the Eustachian tube.

Case VII (A361362).—Mrs. G. L., aged forty years, came to the Clinic, June 15, 1921. Seven years before, following childbirth, the patient noticed difficulty in swallowing. Three years later she became suddenly hoarse; this persisted. She had not coughed, but in swallowing she had difficulty in keeping food from falling into the windpipe or passing into the nose. Six years before, she had noticed gradual wasting and weakening of the right shoulder and arm, which had continued to ache since the onset of the trouble. The tonsils and many teeth had been removed without relief. She had had headache over the right occipital region often. The right side of her tongue had felt thick and at times she had difficulty in speaking.

Examination of the right side of the tongue revealed paralysis and atrophy. The right side of the palate, pharynx and larynx was paralyzed and the right trapezius and sternocleidomastoid muscles were atrophied. The right vocal cord was in the intermediate position. There was a collection of food in the right hypopharynx. Roentgen-ray examinations of the head and of the cervical spine were negative; examination of the eyes and the Wassermann reaction on the blood were negative.

*Summary.* This case illustrates involvement of the ninth, tenth, eleventh and twelfth cranial nerves on the right side, probably owing to a mixed tumor in the region of the jugular foramen.

Discussion. In six of the seven cases in the series there was unilateral complete laryngeal paralysis associated with the jugular

foramen syndrome or other syndromes, and in one case (Case VI) there was paralysis of the right side of the palate and pharynx and involvement of the second, third, fourth, fifth, sixth, eleventh and twelfth cranial nerves and of the cervical sympathetic nerve without laryngeal paralysis. In all the cases in which the larynx was paralyzed the vocal cord was in the intermediate or cadaveric position and not in the middle position usually taken by it after an injury to the recurrent laryngeal nerve.

Cases II and VI are unusual on account of the extent of the involvement of the nerves. In Case II the third, fourth and sixth nerves were probably affected in the orbit, owing to extension of the epithelioma. The fifth and seventh nerves were probably affected intracranially, and the ninth, tenth, eleventh and twelfth nerves by direct extension of the tumor to the region of the jugular foramen. The patient was deaf on the side involved because of encroachment on the Eustachian tube in the nasopharynx. In Case VI a nasopharyngeal tumor affected the second, third, fourth, fifth and sixth nerves probably intracranially, and the ninth, tenth, eleventh and twelfth and the cervical sympathetic nerves in the region of the jugular foramen.

The cervical sympathetic nerve was affected in 4 cases, as shown by myosis and narrowing of the palpebral fissure.

In a review of the entire group several points of interest may be noted. In all of the cases, except possibly Case I, involvement of the nerves was due to neoplasm in the region of the jugular foramen, and even in this case such involvement is the most probable cause, although it is possible the medulla was affected.

In six cases the nerve involvement was caused by a tumor. In four of these cases the tumor was slow-growing and of a low grade of malignancy, the duration of symptoms ranging from two to twelve years. One lesion of the series was microscopically proved to be carcinoma of the mixed-tumor type; two growths were, clinically, mixed tumors and one a recurring basal-cell epithelioma. In two of the six cases the pathologic lesion was a rapidly growing tumor, probably a lymphosarcoma, the symptoms of which were present from three to six months only. In these cases the tumors originated in the nasopharynx and pharynx.

The age of the patients was from thirty-five to sixty-two years

and the duration of the symptoms from six to twelve years. The males and females were about equally affected.

Definite cardiac or respiratory disorders did not occur except in Cases I and V. The patient in Case I complained of palpitation and dyspnea on exertion, but she had been operated on for toxic goiter. In Case V the patient complained of pounding of the heart and dyspnea when climbing stairs. Examination of the heart showed loud systolic murmurs at the apex, transmitted to the axilla.

In examining the patients it was noted that those with paralysis of half of the tongue had trouble in swallowing liquids, an act affected by means of pressing the tongue against the hard palate. Paralysis of the palate caused food to become lodged back of the nose. Paralysis of the muscles of the pharynx interfered with the swallowing of solids.

In some of the seven cases in the series it was difficult to determine definitely the degree of involvement of the ninth and tenth nerves, but this is because of our vague understanding of the anatomy and physiology of this region.

It may be seen from a review of the cases in the literature and of my group of cases that laryngeal paralysis associated with a syndrome due to involvement of the last four cranial nerves and the cervical sympathetic nerve in the region of the jugular foramen is quite unusual. When this occurs it is usually owing to a neoplasm, although a tuberculous process in the glands of the neck or an acute phlegmon may be the cause. During the World War cases were reported due to bullet or shrapnel wounds. The vocal cord is in the intermediate or cadaveric position in vagus involvement.

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# BRONCHOSCOPY

HENRY HALL FORBES, M.D.

This subject has been of interest to the writer from the commencement of his work in laryngology. If one considers the really short scientific history as a whole and the still shorter time which has been devoted to the subdivision, bronchoscopy, the profession must feel duly proud of the progress which has been made. The writer unfortunately has no new procedures to bring to the attention of the Association, but in reviewing a few of his cases with their end-results, together with the conclusions formed in teaching the subject in a post-graduate school, there may be a few points of interest.

Under the heading of bronchoscopy one must also consider the development of esophagoscopy and suspension laryngoscopy. The attempt to view the larynx, the trachea and the esophagus by means of the straight tubes was ideal. The solution of some of the mechanical problems must have been most difficult. The overcoming of the anatomical angles, the straightening of the passages with a metal tube, causing no trauma and with a margin of safety, must have given to the earlier workers a true scientific pleasure. The progress continues. Our work under local anesthesia and the development of the electrically illuminated instruments are mere incidents. The writer marvels at the original work which has been covered by the laryngologist, and this country should feel proud of her part. These names are familiar to every member of the Association and will always be associated with this field of usefulness.

It is the feeling of the writer that bronchoscopy must, in a way, be regarded as a scientific hobby, and "to be happy in this work one must be an enthusiast."[3] It has been his object in teaching to interest as many of the post-graduate students as possible in the subject, feeling that thereby something on his part was being done to kindle the fire in the minds of the beginners,

to whom we must look to continue the development of the work so nobly begun. The correctness of this belief seems upheld by the fact that reports of the experiences of the former matriculates are beginning to materialize, and it is my firm conviction that the number of men who are doing safe and scientific bronchoscopy throughout the country is on the increase. "One of the indications of the progress of endoscopy is that its dicta no longer are laid down by one individual, but are the result of the combined experience and thought of numerous students of this branch of surgery. Only through the observations and citations of those interested in this work has this science developed to its present degree of accuracy, and only in this way can its advancement continue."[2] This necessity for workers is again emphasized very aptly by Dr. Carpenter,[1] of Greenville, S. C., who reports 40 cases, noting the fact that "One man working in a small community has seen this number of foreign-body cases in so limited an area."

With the working knowledge given in the present course in bronchoscopy the student acquires a sufficient technic by practice on the cadaver and the dog to enable him, with a little hard work, to improve his working knowledge and to meet the more involved problems as they present themselves. It would seem that at present no medical man who claims to practice otolaryngology can fail to include a working knowledge of the use of the direct laryngoscope and esophageal speculum, *i. e.*, a sufficient knowledge to examine and diagnosticate disease in the larynx and upper esophagus. No doubt the members of the Association interested in the development of the post-graduate courses have this in mind, but it will do no harm to have it emphasized in making up the standard of requirements.

While the field of work was limited in the beginning one views with satisfaction the present position of the bronchoscopist who has added to his field of foreign-body work the more advanced use of our experience in accurate diagnosis; and, lastly, our aid is sought by the surgeon and internist for possible therapeutic possibilities, notably the treatment of tracheal lesions, lung abscess, and the scientific application of radium to laryngeal and esophageal new growths.

If the use of the esophagoscope be considered only in the diagnosis and treatment of disease of the esophagus, thus enabling one to locate and to study the field and later to note the results of the therapeutic efforts, great advances have undoubtedly been made. In the light of present-day direct work one can only speak of the older or blind methods of treatment to condemn them. And yet cases are observed in which the use of this method of examination has been overlooked by advanced workers. An example of the fallacy of blind work is illustrated in the following case: A few years ago the author was asked to be present at an examination of a patient by a surgeon, and his services were to be used if the surgeon was unable to remove a foreign body. The history, briefly, was as follows: A girl, aged thirteen years, had swallowed an open baby-pin. The roentgen ray showed the pin open in the neck, in the median line, the lower end just below the larynx. There was no change in voice; no dyspnea; slight difficulty in swallowing. The suregon believed the object to be in the upper esophagus and easily removable. Laryngeal examination before anesthesia did not show the object in the larynx; later it could not be felt or seen in the esophagus. The case then became one for the bronchoscopist. An esophagoscope was passed with a negative result. As a precaution the bronchoscope was passed and the object was discovered at the bifurcation of the trachea and successfully removed. The pin had changed its position after the roentgen ray or the change was due to the relaxation of anesthesia.

A stomatologist seemed surprised when the suggestion was made that the use of the esophagoscope might help him in differentiating between cardiospasm and malignant disease. Special emphasis was made by the writer at the time that a death had recently occurred in a patient with malignant disease of the esophagus which had been treated as a cardiospasm for nearly a year. Here the diagnosis might have been made early by the use of the esophagoscope. Dr. Sheehan[3] speaks of his recent success in the treatment and cure of esophageal ulcer by the use of the esophagoscope.

An attempt will now be made to emphasize briefly a few

essentials in bronchoscopy as they have been brought home to the writer in his work. The first operative case which came under his care illustrated that a knowledge of tracheotomy and when to use it was quite necessary to the beginner. This was the case of a child only twenty-five months old. Two attempts had been made to remove a lace-pin. As the child was septic a short unsuccessful bronchoscopic search was made before performing a tracheotomy. The introduction of a small bronchoscope through the tracheotomy wound was followed by a coughing attack, the pin being ejected through the tube by a blast of air. Tracheotomy and lower bronchoscopy have always been included in the teaching of the writer, and that tracheotomy when necessary was not a mark of a poor operator.

Another case illustrated the failure to obtain a complete history. This was a hospital case. The boy, aged four years, had been in the hospital for an indefinite or undiagnosticated pulmonary condition. He was sent to a convalescent home and later readmitted to the hospital. In all some five months had passed; then the parent told the house physician that shortly before the child's illness began he had swallowed a nail. At once a roentgen ray which had not been taken was ordered; the plate showed the presence of a good-sized nail. The case was then referred to the writer and a very rusty nail was removed.

Cases are coming to us frequently with foreign bodies of new types or presenting new positions. True, our instruments are increasing in number and new types of grasping forceps seem necessary. These problems are being successfully solved, although in some our ingenuity is being taxed. A bead was successfully removed recently by use of the three-point grasping forceps; partly by accident the first closure of the forceps seemed to grasp the bead; it was removed and two of the points of the forceps had entered the two small openings of the head.

All observers warn of the necessity for accurate histories and proper interpretations of symptoms and preliminary examination by the medical confrère, and here again may be noted a case with a positive history and negative roentgen ray and physical signs. A large almond was lodged in the trachea of a boy and consultation advised waiting. Yet in this case, within an hour, the child

developed a cough and cyanotic attacks occurred, which had been reported by the mother; he was seen by the writer in one of these attacks. The almond was later removed.

In most cases there is a history of a definite choking spell varying in intensity from a transient cough to violent attacks of dyspnea. Jackson has truly said that cough was the watch-dog of the lungs. It is my firm belief that with a positive history, notwithstanding a negative roentgen ray, the patient is entitled to the benefit of the doubt and an examination should be made.

Accidents will occur in bronchoscopy as in surgery in general; many of such cases were reported by me in a paper read at the twenty-second annual meeting of the American Laryngological, Rhinological and Otological Society. A new accident, illustrative of the excellent precaution of having two sets of instruments ready, occurred in the case in which the almond was swallowed. When about to change my 4 mm. bronchoscope to a 5 mm. tube, and asking to have the overhead lights turned on to make this change, the assistant turned both switches of the Jackson battery, thinking more current was needed; both the light on the laryngoscope and bronchoscope were burned out, and of course the child took this unfortunate time to cough, the almond changing its position and becoming lodged below the cords, causing extreme cyanosis; a rapid tracheotomy alone saved the child's life.

Cases of foreign body of dental origin are not rare, and it is well, as noted by me in a paper read recently, "Bronchoscopic Cases of Dental Origin," that the dentist should be fully informed of his responsibility in these cases; none should be overlooked, both for the safety of the patient as well as the medicolegal aspect of the case. The entrance of the foreign body into the lung was noted by the dentist in 2 cases, but not discovered in the other 2 cases until symptoms of irritation of the lung resulted; 1 case when seen had developed a lung abscess.

What can we learn from our esophageal experiences? First, in our technic two much stress cannot be made on two important precautions in our work, gentleness and an open field ahead as we advance our tube. Roughness and blind advancement of the tube are never justifiable.

The writer feels quite repaid for much of his work in the satis-

faction which has been made possible in noting the results of the effects of the radium applications in esophageal new growths. Full notes of this work have been covered by others as well as by the article read by the writer at the 1921 meeting of the American Bronchoscopist Society.

Suspension laryngoscopy has also been a source of much scientific pleasure to the writer, the use of the instrument, using the Lynch technic, giving to the surgeon the widest scope for operative work. One is not surprised at the accomplishments of many operations by Dr. Lynch, who seems to have developed a wonderful technic and broadened the field of usefulness of the instrument by his successful work. We cannot all be a Lynch but we can all avail ourselves of his work and make a bold attempt to follow. The advantage gained to the surgeon in this method is in having two hands with which to work and the not great discomfort to the patient, with the head resting on the table, has facilitated the work of the writer in the removal of the epiglottis and newgrowths of the larynx. The wonderful opportunity thus afforded the student to follow the work is also a most decided advantage in a teaching hospital.

This would seem to be the limit of our field. Perhaps this is true, but time alone will tell us. However, when we consider our brief working years and the problems overcome, the writer feels much more can be accomplished.

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# PRESENTATION OF INSTRUMENTS AND PATIENTS

## Specimen of a Larynx that had been Operated upon for Carcinoma of the Vocal Cord Twenty-five Years Ago

PERRY G. GOLDSMITH, M.D.

I appreciate very much your indulgence which allows me to present this specimen. Twenty-five years ago Sir Henry Butlin removed the right vocal cord for carcinoma. The man remained well until a year ago, when he felt a hard and fixed mass below the angle of the jaw. I saw the man. His tonsil projected forward; the mass was apparently external and posterior. No ulceration was to be seen and he had no complaint regarding the tonsil. Eventually he died and this is his larynx. A section for examination was made through the tongue. The anterior pillars were involved and the lingual area has been sectioned also. This shows the larynx twenty-five years after he had thyrotomy, and I think that in itself is very unique. It also shows the larynx of a man who died of carcinoma of the pharynx and tongue twenty-five years after he had been cured of carcinoma in another region.

## A Tack and Pin Forceps

CHEVALIER JACKSON, M.D.

We all recollect, on the farm, leading the calf or bulldog, how they got around the other side of the tree and held up proceedings. As you know there is a very strong tendency on the part of a small pin or any other kind of a pin at bronchoscopy to do a

similar thing, namely, to get crosswise of the tube-mouth. For twenty years I wished for something that, in the first place, would not let the pin slip out of the forceps, and in the second place would bring it parallel to the bronchoscope. I was very close to a solution of the problem but too stupid to see it. My assistant, Dr. Tucker, devised this forceps. It will not only prevent losing the pin but will bring it parallel to the axis of the bronchoscope. If the pin gets around crosswise, like the calf or the dog on the other side of a tree, the forceps jaws throw it back. It is one of the most ingenious things I ever saw in my life, and my assistant, Dr. Gabriel F. Tucker, deserves congratulations on his ingenuity.

## Sarcoma in the Left Nasal Cavity

CORNELIUS G. COAKLEY, M.D.

This patient was referred to me a year ago last November by Dr. Mason, of this city. She had had two or three intranasal operations for a small round-cell sarcoma involving the left nasal cavity, supposed to be somewhere in the region of the middle turbinate. The entire nasal cavity was filled with the mass. It was impossible to tell the point of attachment, and I refused to do anything intranasally and insisted upon an external operation. The operation was done November 18, 1920. An incision was started, as I do in my ethmoid work, from the region of the supra-orbital notch and carried down more on the cheek, because I rather expected from the size of the mass that it would probably involve the maxillary sinus as well as the ethmoid region, and even possibly the frontal. The whole of the nasal bone was removed and the nasal process of the superior maxilla. On opening the ethmoid cells there was a very large mass found, which I grasped with a pair of forceps, and in pulling it out I was surprised to find attached to it a piece of bone. This proved to be the whole of the cribriform plate of the ethmoid that left the dura exposed. There was no involvement of the antrum nor of the frontal sinus. I expected to have the patient develop a meningitis and a rather quick exitus. There was no evidence

of headache or meningeal irritation. About three weeks after operation radium was used externally, and up to this present time there is no recurrence within the nose. I show her because of the lack of deformity that can be gotten through a wide area of exposure through the ethmoid. Even a fastidious patient cannot object to the cosmetic results of this operation.

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## Dacrocystitis

CHARLES W. RICHARDSON, M.D.

I had four cases of dacrocystitis I had expected to show before this meeting today, but, being called at an earlier hour than I had anticipated, only two have arrived, and in order to prevent any delay I present them to you. These were operated upon by the Mosher-Toti method. This operation is the Toti operative method modified by Mosher, and, if I may say it, the operation is more simple than the reading of Mosher's description of it would give you the impression.

The first case which I present to you was that of a most serious infection of the sac and of the soft tissues both above and below the eye. Pus was coming from everywhere. The conjunctiva was ulcerated to the corneal border and a slight small ulceration of the corneal border was manifesting itself. This was the most unpromising case I have ever seen in which I have attempted to do this operation. The operation was done four weeks ago. In this case, as we would naturally expect, there was a week of suppuration from the lower portion of the incision; but this gave me no concern, as I was certain it would clear up through good aseptic dressings.

The second case, in which the result as you see is just as satisfactory as the case just demonstrated, was an old, purulent, distended sac which was pouring pus along the border of the lower lid and into the nasal chamber. This case is the result of an old, nearly spent, atrophic rhinitis. When the patient was put on the table I noticed that there was a perforation at the lower portion of the anterior wall of the sac from which pus was bubbling.

This patient made a most uneventful and, as you see, a most resultful recovery—no suppuration and no epiphora. In the first case I demonstrated to you the young woman is still troubled with a little epiphora.

I want to show these cases to demonstrate to you that they are cases for the laryngorhinologist. They are cases that from your knowledge of the nasal chamber, the lacrimal sac and canal only you are capable of doing and giving perfect results. I think we owe to Dr. Mosher a great deal for his having revived the Toti operation and, through his insistence and demonstration, showing what can be accomplished through it and how easy it is of accomplishment.

### Discussion of Dr. Richardson's Presentation of Cases

Dr. John F. Barnhill, Indianapolis, Ind.:

After reading an account of Dr. Mosher's operation I worked it out on the cadaver first and saw that it was good. Then fortunately I had some patients in whom I could apply the technic to the living, and I found, as I believe, that it was better than any heretofore devised. It was better because it enabled one to work in an entirely open field, to see exactly what he was doing at all times, and to do what I believe is a very essential thing, namely, to make adequate drainage of the part that must be drained. The cases that I have done, four in number now, all did wonderfully well. There was so little scar that the patient did not complain of it, and there has been absolute cure up to the present time. I do not know what ten years will do. It may be they will ultimately behave like the nasofrontal duct after operation and that in due time there may be closure or partial closure. They have shown no such tendency so far, the patient has had perfect comfort in every way, and I am entirely satisfied that the operation is a good one, and therefore can recommend it.

# Memorials

# WILLIAM PORTER

1850—1921

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Dr. William Porter died at Ocean Springs, Miss., November 13, 1921, at which place he had been residing, after his removal from St. Louis, for the past seven years. He was born in Rochester, Beaver County, Pa., in 1850.

His early life was spent at Beaver, Elderton, Pittsburg and Philadelphia, in which places he received his early education.

He graduated from Westminister College (Pa.) in 1869 and from the Jefferson Medical College, Philadelphia, in 1872.

He then went abroad for purposes of graduate study, and in the years 1872–1873 acted as assistant to Sir Morrell Mackenzie at the Golden Square Hospital for Diseases of the Throat and as intern upon the house staff of the London Hospital.

Subsequently he spent several months studying at the Laryngological clinics at Paris, Berlin, and Vienna.

He entered upon the practice of medicine in St. Louis in 1874, specializing in diseases of the throat and chest.

Although one of the original members of the American Laryngological Association, he quickly departed from the strict field of laryngology and devoted himself almost exclusively to diseases of the chest, with special reference to tuberculosis, his practice, appointments, instructorships, and writings being almost entirely devoted to this department, with the exception of an early paper published in the late 70's upon "Asthma from Reflex Nasal Causes" and another upon "Excision of the Epiglottis." He contributed in all five papers to the *Transactions* of this Association.

In 1884 he was married to Miss Pearl E. Dickinson, of New York, after whose death, a number of years ago, he shortly married again.

APPOINTMENTS HELD, ETC.

Physician to St. Luke's Hospital, 1875–1890; Medical Director of Mount St. Ross Hospital for Tuberculosis, 1890–1909; Professor of Clinical Medicine, St. Louis University, 1901–1909; President and Medical Director of State Sanatorium for Tuberculosis, 1900–1910; President and Medical Director of St. Louis Commission for the Prevention of Tuberculosis, 1904–1908; Director of National Association for the Study and Prevention of Tuberculosis, 1906; Ex-President of the Mississippi Valley Medical Association; Honorary Fellow of St. Louis Medical Society; Honorary Member of American Medical Editors' Association; Fellow (Retired) of American Laryngological Association; Affiliate Fellow of American Medical Association. (The only member so elected thus far.)

HENRY LOWNDES LYNAH, M.D.

# HENRY LOWNDES LYNAH

1878—1922

In the untimely death of Dr. Henry Lowndes Lynah the science of medicine has lost one of the most brilliant lights which have dawned upon it in this present generation, while from those who knew him has been removed a friend possessed of the rarest qualities.

His parentage was purely Southern. His father, Arthur Lynah, of Grahamville, S. C., is the son of Edward and Eliza Glover Lynah, of the same place. Edward Lynah was president of a bank. Dr. Lynah's mother, Mary Ancrum Lynah, is the daughter of James Hasell and Eliza Russell Ancrum, of Beaufort, South Carolina.

Dr. Lynah was born in Charleston, S. C., December 1, 1878. He died at his father's home in that city, March 31, 1922.

His early education was gained in the neighborhood of his home, namely, at the high school, the Porter Military Academy, and the University School of Charleston. He graduated from the latter in 1896. In April, 1900, he graduated from the South Carolina Medical College and immediately thereafter entered the Johns Hopkins Hospital as extern, later becoming an intern in that institution. Having served a long and highly valuable term there he removed to New York City, where he secured an internship at St. Mark's Hospital, then at the Kingston Avenue Hospital. Later he became assistant resident and finally resident house officer at the Willard Parker Hospital.

Dr. Lynah quickly established a remarkable reputation for earnestness, integrity and ability, and it was not long before he began to make himself known outside of these hospital connections, his high professional value being recognized by the distinguished

men with whom he associated at the Willard Parker and Riverside Hospitals, institutions largely devoted to the care of patients suffering from diphtheria and scarlet fever. Under the supervision and encouragement of such men as Dr. William Hallock Park, Dr. John Rogers and others with whom he was associated, he acquired great skill in the department of cases suffering from chronic stenosis of the larynx. Experimenting with the known methods used for this purpose he evolved and developed ideas of his own which soon placed him in the front rank of those who had given special attention to these very stubborn and serious cases. As his reputation grew he became connected with other institutions by which his services were eagerly sought.

The exposition of his improved methods and their successful results made in a thesis presented by him before the New York Academy of Medicine several years ago, and also presented before the Section on Laryngology of the American Medical Association in June, 1914, marked an epoch in this branch of science.

He early interested himself in the science of bronchoscopy and soon attained a refinement of skill which has probably not been more than once equalled in this country.

In the devising of new instruments and of new methods for simplifying their application he stood preëminent. These accomplishments, however, belong to the mechanical side of practice. Far more important features were those qualities of mind which rendered his judgment clear, well-balanced and accurate to a degree seldom attained by one of his years.

In addition to the above special accomplishments he was remarkably well grounded in the science of laryngology and rhinology in general, highly skilled in the diagnosis and treatment of diseased conditions of the nasal sinuses, and a thoroughly well-equipped practitioner in all the branches of medicine.

At the time of his death he was actively engaged in the practice of his specialties at the Willard Parker, the Riverside, the Kingston Avenue, the Queensboro and the Otisville Hospitals. He was consulting bronchoscopist and esophagoscopist to the French, Lenox Hill, the Skin and Cancer, and the Methodist Episcopal Hospitals, and to the New York Eye and Ear Infirmary and St. Bartholomew's Clinic and Hospital.

He was for sometime an instructor in laryngology and intubation at the University and Bellevue Medical College and was subsequently elected professor of bronchoscopy in the New York Polyclinic.

Dr. Lynah was one of the founders and the third president of the American Bronchoscopic Society. He was a member also of the American Laryngological Association (elected in 1919), of the American Laryngological, Rhinological and Otological Society, the American Academy of Ophthalmology and Oto-Laryngology, the Alumni Association of the Johns Hopkins University, the American Association for Thoracic Surgery, the New York Academy of Medicine, the American Medical Association and the Medical Society of the County of New York. He was chairman of the Laryngological Section of the State Medical Society for the present year (1922), and for this meeting had by diligent efforts secured a program of unusual interest and scope.

During the late war his services as a member of an important examining board were devoted, arduous, and invaluable.

Dr. Lynah was unmarried.

He was a lover of outdoor sports, especially of tennis and baseball, in both of which he excelled. But his chief delight was in music, of which he was very fond. As a vocalist he possessed a baritone voice, well cultivated and of unusually fine quality.

Denominationally, he was an Episcopalian; politically, a Democrat.

His loss, coupled with that of Dr. Friedberg last year, removes from our Association the two brightest stars of its younger constellation and inflicts an irreparable loss upon the progress of scientific medicine, for with such unusual successes already attained in early professional life the possibilities of future accomplishment were as certain as they were unlimited.

The highest tribute possible to any man is the sincerity of the grief at his loss manifested by those who held him in affection and esteem. In the case of Henry Lynah this testimony was deep, sincere, and universal. Throughout his varied and remarkably wide acquaintance he had invariably commended himself for his ability and endeared himself by his rare personal qualities as had few men of his time.

His whole career was one of untiring devotion to the welfare of others under circumstances of peculiar difficulty and personal risk.

Intellectually brilliant and resourceful, temperamentally kind and genial, in character strong, truth-loving, and pure, a noble physician and a true gentleman,

"None knew him but to love him,
None named him but to praise."

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5. Foreign Body in Left Bronchus.

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7. Osteomyelitis of the Sinuses of the Nose Complicating Scarlet Fever, Laryngoscope, St. Louis, 1917, xxvii, 176.

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Executive Session
1922

# EXECUTIVE SESSION

Monday, May 1, 1922

The Forty-fourth Annual Congress of the American Laryngological Association was called to order, Monday, May 1, 1922, at 10 A.M., by the President, Dr. Harmon Smith, at the Hotel Raleigh, Washington, D.C. During the reading of the Presidential Address, Samuel Johnston, Honorary President, occupied the Chair.

The President introduced as guests of the Association Prof. Waichiro Okada, of Tokio, Japan; Dr. I. Chandler Walker, of Boston, and Dr. Francis M. Rackemann, of Boston.

Dr. John N. Mackenzie was elected an Honorary Fellow of the Association.

Dr. Alexander W. MacCoy, of Philadelphia, and Dr. Frederic C. Cobb, of Boston, were elected Emeritus Fellows of the Association.

The following were elected to Active Fellowship:

Dr. Gordon B. New, Rochester, Minn.
Dr. Henry Hall Forbes, New York City.
Dr. Perry G. Goldsmith, Toronto, Ontario.
Dr. David J. G. Wishart, Toronto, Ontario.

The Auditing Committee, appointed by the President, consisted of Dr. Joseph B. Greene and Dr. R. Bishop Canfield.

The following Nominating Committee was elected by the Fellows of the Association:

Dr. D. Bryson Delavan
Dr. Henry L. Swain
Dr. Harris P. Mosher
Dr. Charles W. Richardson
Dr. George E. Shambaugh

The Secretary announced that Dr. Joseph H. Bryan would give a luncheon to the Fellows and Ladies of the American Laryngological Association following the morning session.

# ANNUAL BUSINESS MEETING

Tuesday, May 2, 1922

The Annual Business Meeting of the American Laryngological Association was called to order by the President at the Hotel Raleigh, at 10 A.M., at which time the following reports were read:

## Report of the Secretary

The Secretary reports that the last annual meeting of the Association was held at the Hotel Chelsea, Atlantic City, on May 30 and 31 and June 1, 1921, under the Presidency of Dr. Harris P. Mosher. There were present sixty-two Fellows and numerous guests. Twenty-two papers were presented, three of them by distinguished guests: Dr. Lawrason Brown, Dr. Carroll E. Edson and Dr. Charles H. Frazier. The annual banquet was attended by fifty-five fellows and guests.

The Secretary reports with regret the death of Dr. William Porter, of St. Louis, Emeritus Fellow, in November, 1921, and of Dr. Henry L. Lynah, of New York, Active Fellow, in March, 1922.

Dr. John N. Mackenzie has been elected an Honorary Fellow and Dr. Alexander W. MacCoy and Dr. Frederic C. Cobb have been elected Emeritus Fellows. This, with the addition of the four new Fellows elected yesterday, Drs. New, Goldsmith, Wishart and Forbes, makes the Active Fellowship list stand at eighty-five, just where it was last year. There are in addition four Associate Fellows.

There have been two meetings of the Council. The report of the Annual Meeting, which was held in New York on January 14, 1922, follows:

## The Annual Meeting of the Council

The Annual Meeting of the Council was held on Saturday, January 14, 1922, at the residence of the President, Dr. Harmon

Smith. There were present Drs. Harmon Smith, Lee W. Dean, J. Payson Clark, Joseph H. Bryan, Cornelius G. Coakley, Thomas H. Halsted, Norval H. Pierce, Harris P. Mosher and George M. Coates.

The Secretary announced with regret the death of Dr. William Porter, of St. Louis, Emeritus Fellow, who died November 13, 1921, at Ocean Springs, Miss.

The Council nominated to the Association for:

*Honorary Fellowship:* Dr. John N. Mackenzie, Baltimore, Md.

*Emeritus Fellowship:* Dr. Alexander W. MacCoy, Philadelphia, and Dr. Frederic C. Cobb, Boston.

*Active Fellowship:*

Dr. Henry H. Forbes, New York City.
Dr. Gordon B. New, Rochester, Minn.
Dr. Perry G. Goldsmith, Toronto, Canada.
Dr. D. J. Gibb Wishart, Toronto, Canada.

The names of Drs. Grant Selfridge and Edward C. Sewall were retained on the list for further consideration.

The Council *elected* as Associate Fellows:

Dr. Harold I. Lillie, Rochester, Minn.
Dr. Francis W. White, New York City.
Dr. Vilray P. Blair, St. Louis, Mo.
Dr. Otho L. Monroe, New York City.

Drs. Harold M. Hays and Roy A. Barlow were held for further consideration.

Dr. Emil Mayer was reappointed Abstract Editor for the ensuing year, subject to the approval of the Association.

The Council arranged to hold the Annual Meeting of the Association this year in Washington, D. C., May 1, 2 and 3, in connection with the Congress of American Physicians and Surgeons. The Hotel Raleigh was selected as headquarters and Dr. Joseph H. Bryan was appointed the representative of the Association on the Committee on Arrangements of the Congress.

## Second Council Meeting

The second meeting of the Council was held at the Hotel Raleigh, Washington, D. C., on April 30, 1922, Vice-President,

Dunbar Roy, acting as chairman, and the following Fellows being present: Drs. Coakley, Pierce, Mosher, Bryan, Clark, Roy and Coates.

The Secretary was authorized to use his discretion in furnishing certain libraries with free copies of the *Transactions* and also to send free copies to all Honorary, Corresponding and Emeritus Fellows.

The Council recommended to the Association the following amendments to the By-Laws. Amend Article VI by adding the following clauses:

7. That all cuts used to illustrate papers published by Fellows in the *Transactions* shall be paid for by the authors of the articles.

8. Unless the contributor is present at the meeting and reads, or is prepared to read, his paper, it shall not be published in the *Transactions* except by a special vote of the Council.

The Council also recommended:

1. That the Abstract Editor, Dr. Emil Mayer, be authorized to select his own assistant.

2. That the sum of fifty dollars be appropriated for the use of the Abstract Editor.

3. That the Treasurer be authorized to repay such proportion as is possible of the loan made to the Association last year by one of the Fellows.

Drs. Delavan, Jackson and Pierce were designated official Delegates from the Association to the International Otological Congress, to be held in Paris, July, 1922.

Drs. Coakley, Bryan and Mosher were nominated as representatives of the Association on the Board of Governors of the American College of Surgeons for the term expiring in 1925.

GEORGE M. COATES,
Secretary.

The report of the Secretary was accepted and ordered placed on file.

The Secretary announced that Dr. Charles W. Richardson would give a luncheon to the Fellows and Ladies of the Association following the morning session.

The Auditing Committee having reported the Treasurer's account to be correct, it was moved, seconded and carried that it pursue its usual course.

## Treasurer's Statement to May 1, 1922

*Receipts*

| | |
|---|---|
| Balance from old account | $473.65 |
| Dues (1921) collected | 90.00 |
| Dues (1922) collected (75 Fellows) | 1875.00 |
| Dues (1922) collected (2 Associate Fellows) | 30.00 |
| Sale of *Transactions* | 278.00 |
| Interest on deposits | 4.19 |
| Postage, express and exchange | 4.77 |
| Secretary toward 1921 Stenographer | 44.80 |
| | $2800.41 |

*Expenses*

| | |
|---|---|
| Lantern slides (1921 Meeting) | $12.00 |
| Stenographer (1921 Meeting) | 169.80 |
| Secretary, 1921–1922 | 300.00 |
| Circular, "Training Specialists" | 10.00 |
| Abstract Editor | 50.00 |
| Printing, 1921, programs, etc. | 138.65 |
| Halftone plates (Dr. Delavan) | 18.75 |
| Treasurer's Expenses | 9.14 |
| Canadian Exchange | 1.92 |
| Chicago Medical Book Company | 1.65 |
| McConnell Press | .50 |
| American Express Company | 8.17 |
| Balance in Bank | 2079.83 |
| | $2800.41 |

## ASSETS OF THE ASSOCIATION

| | | |
|---|---|---|
| *Invested* | | |
| De Roaldes Prize Fund | $500.00 | |
| Accrued interest to February 1, 1922 | 187.37 | |
| | | $687.37 |
| Casselberry Legacy (bonds) | $5000.00 | |
| Accrued interest to February 1, 1922 | 1084.40 | |
| | | 6084.40 |
| *Current* | | |
| Unpaid dues | $200.00 | |
| *Transactions* and express | 40.92 | |
| Bank Balance | 2079.83 | |
| | | 2320.75 |
| Total assets | | $9092.52 |
| Liabilities, loan | | 1489.00 |

Respectfully submitted,
J. Payson Clark,
Treasurer.

Audited and approved:
R. B. Canfield,
Joseph B. Greene,
Auditing Committee.

### Report of the Librarian

The Librarian, Dr. Joseph H. Bryan, reported no additions to the Library during the current year.

### Report of the Abstract Editor

The Forty-third Congress of the American Laryngological Association was held on May 30, 1921.

The original articles were either abstracted by the readers or by the Abstract Editor.

The stenographer's report of the discussions were received from

the Secretary on July 11. These were abstracted and sent to the Fellows for correction on July 20, so that each member had an opportunity to make corrections.

On August 15 the abstract proceedings were sent to the printer, as also an additional copy to the *New York Medical Record*.

On October 15, galley-proofs were received from the editor of *The Annals of Otology and Laryngology* and sent promptly to the special journals (*The Laryngoscope* and four foreign journals).

The *New York Medical Record* published the proceedings on October 22 and 29, 1921.

Your Abstract Editor acknowledges the cordial coöperation given by Dr. Imperatori, Associate Editor; the latter will act in the same capacity during the ensuing year.

Respectfully submitted,

EMIL MAYER,
Abstract Editor.

## REPORT OF THE DE ROALDES PRIZE FUND COMMITTEE

Dr. Delavan stated that inasmuch as the de Roaldes Prize, although offered three times in nine years, has never called forth a thesis which has been considered worthy of its award, and as the money is at present lying idle, he would like to suggest that the Committee be not restricted to offering the prize once in three years only. The original reason for restricting the award of the prize to once in three years was because there was not sufficient money to make it an annual offering.

The announcement that the de Roaldes prize would be open for competition this year was widely advertised in the leading medical journals of the United States and England. Two theses were offered. The Committee reports that neither was considered worthy. The Committee, therefore, recommends that the prize this year be not awarded.

Dr. Jackson moved that the Committee be authorized to use its discretion as to the offering of the prize and that the report of the Committee be accepted. This motion was seconded and carried.

## The Report of the Committee on Control of Cancer

### Condensed Report of the Work of the American Society for the Control of Cancer Since its Organization

As I am allowed but five minutes in which to report on behalf of the American Society for the Control of Cancer a résumé of its activities I shall confine myself to the main features of its progress in the past nine years.

You, of course, know of its organization—that it grew out of a report by a Special Committee of the American Gynecological Society made here in Washington at the Triennial Congress of American Physicians and Surgeons, in 1913, and that you appointed delegates at that time to represent the American Laryngological Association in bringing the Cancer Control Society into being. I do not need to dwell upon the necessity for such a Society. There are still thousands of people in this country who have no exact information concerning the simplest signs of cancer, and it is therefore essential that, if that total of 90,000 deaths a year is to be cut down, some such organization for public propaganda exert itself to the fullest to acquaint the people with these vital facts and persuade them to undergo examination and treatment while the disease is still in an early stage.

The Society also undertakes to bring additional knowledge concerning the diagnosis and treatment of cancer to members of the medical profession at large. In this connection a very significant and important fact is being noticed. Experience in the localities in which our campaign of education has been most active, already makes it evident that the day is not far distant when the general practitioner who fails to take, with the utmost seriousness, cases which in any degree suggest potential cancer when at the first visit, or who fails to suggest an immediate, modern physical examination in the internal cases, will find himself looked upon by even his own patients as incompetent and unworthy of their confidence or patronage. The education of the whole profession to the fact that the submission of incipient malignant disease to the test of time and development deprives the patient of his chance of life, and that no time should be lost before providing the most complete and expert physical examination, is as important to the profession as it is to the public.

As soon as the Cancer Society started active work on January 1, 1914, under the tireless and tactful direction of Dr. Clement Cleveland, as chairman of the Executive Committee, it began to publish and distribute authoritative literature, and large mass meetings for the public were held in about a dozen of the largest cities, as a result of which some very active state and local committees were formed. Since then over one thousand eight hundred persons have been enrolled as members. The extent of this work and the recognition of its value were constantly enlarging until it was obliged to mark time during the war period. When the active professional men finally returned to peace-time pursuits it was soon found that the demand for the information and service which this little Society and its representatives were specially equipped to supply was more widespread than ever, and under the stimulating Presidency of Dr. Charles A. Powers, of Denver, an extension of the field-organization was effected. By this means each state now has its activities led by a prominent physician or surgeon, it being felt that only by the closest alliance between the Society and the medical profession could the best results be hoped for. The confidence of the profession in the work of the Cancer Society is most encouraging, and indicates that its efforts are considered constructive and helpful in allaying fear and inspiring hope among cancer sufferers, and in bringing the known facts concerning cancer to the attention of the public. The publications of the Society are a fair index of the care and though as well as the energy which is being expended by the active members of the Board of Directors. I mention specially the *Handbook for Physicians* and the *Handbook for the Lay Reader*, each prepared by a committee specially appointed for the purpose.

The success of the National Cancer Week conducted by the Society in coöperation with the country's official and nonofficial health agencies, last fall, is perhaps the truest measure of the cumulative effects of the Society's organization and educational program up to date. You all heard of the special "week," and probably many of you had a part in it. One of the most noteworthy features of the campaign was the almost universal coöperation of the medical profession, and the reports since received by the Society from all over the country prove that many hundreds

of people received information which resulted in sending them to their doctors for consultation and advice. During this remarkable week's activities detailed reports from twenty-eight states show over 2500 lectures given before more than 600,000 persons, and that several hundred thousand more received the message by short addresses in churches, lodges and theaters. Upward of 5,000,000 pieces of literature were distributed, and taken together with the display posters, lantern slides in moving picture houses and the enormous newspaper and magazine publicity it is conservatively estimated that no less than 10,000,000 persons received the simple facts of cancer control either directly or indirectly during that remarkable activity of seven days' duration. Let me take this opportunity to announce that a second "cancer week" will be held from November 12 to 18 next. The Society has asked me to enlist your active interest and aid in making this week even more effective than the last.

While the cancer week campaign was purely educational and was separated from any attempt to raise funds, as a matter of principle it indirectly redounded to the Society's advantage. Since then two notable grants have been made to the Cancer Society—one a memorial endowment of $50,000 from the Lasker family in New York, the income to be spent for educational material, and the other a special appropriation from the Commonwealth Fund of New York City, amounting to $26,750, to establish a Field Service. This should make it possible to greatly extend the Society's usefulness. Not only will it provide for the employment of a travelling field organizer to assist the various committees with their work, but will also enable the Society to prepare and distribute far more educational material and to carry on a wider and more continuous publicity campaign.

This, in a very brief way, summarizes the progress made by the American Society for the Control of Cancer since we helped to launch it in 1913. It enjoys a well-merited position among the other nonofficial health agencies, and I commend its work and its support to your consideration.

D. Bryson Delavan.

It was moved and carried that the report be received with thanks and the Committee be continued.

## Report of the Committee on Tonsil Investigation

The printed report of the 1912 Association meeting mailed to the members contains this paragraph:

The following Committee was appointed to investigate the tonsils, as embodied in the resolution proposed by Dr. George Richards, of Fall River:

Dr. George L. Richards, Fall River.
Dr. J. Payson Clark, Boston.
Dr. Henry L. Swain, New Haven.

The purpose of the Committee, as outlined in a recent letter from Dr. Richards to the present chairman, was as follows:

It was started some ten years ago at a time when nearly all of the tonsil literature was concerned with the mechanics of removal. It seemed to me then that the time was ripe for starting an investigation as to what were the physiology and pathology of the tonsil, and as to why and under what circumstances we should recommend its removal. Several meetings were held and conference was had with Dr. Jonathan Wright and an attempt made to finance and start an investigation, but that is as far as it went. Dr. Wright left New York and the attempt to finance an investigation was given up, and, as a matter of fact, the scheme has lain dormant ever since. The original purpose was to publish something which might be reasonably authoritative, based on carefully observed cases applying for treatment of definite symptoms, and to have observed these cases over a sufficient length of time, after their first appearance, to come to some reasonably correct conclusion as to the function and pathology of the tonsils, and as to whether, after their removal, the patient was really better or worse.

In the endeavor to ascertain what the Committee had planned and had accomplished the present Committee studied a mass of notes and correspondence formerly in the hands of Dr. Richards. This material could be separated into three parts:

I. An outline of points to be studied.

II. The division of this work among the members of the Association.

III. Attempts to finance a laboratory investigation.

I. The points of suggested study comprise a list of twenty-five, and are as follows:

1. The comparative anatomy of the tonsil in such animals as the guinea-pig, the rabbit, the pig, the monkey.

2. Its embryological development in the human animal.

3. Its anatomical relationship to the lymphatic system, especially that of the mouth and the nasopharynx.

4. Its relation to voice production.

5. The effect of its removal on voice production.

6. Its normal physiology, if it has any.

7. At what period of life is the tonsil functionally active?

8. Is it of value before puberty? Is it of no value after puberty?

9. Its relation to tooth development, if any.

10. Its relation to digestion, if any.

11. What is a normal tonsil, both as to size and appearance?

12. When does the tonsil become abnormal?

13. Is there any evidence that its removal does in any way damage the individual?

14. What are the indications for its removal?

15. Is it removed for mechanical or pathological reasons?

16. If removed, should it be removed partially or completely, and if so, why?

17. Should the operation be any different as to amount removed in child and adult.

18. The accidents and unfavorable sequelæ of removal—hemorrhage, subsequent infections and the like.

19. The mortality of removal.

20. The end-results of removal in cases observed at least over a period of three years.

21. What is the relation of the tonsil to systemic diseases, such as rheumatism?

22. What is the relation of the tonsil to diphtheria?

23. Are there fewer cases of diphtheria and other throat infections in tonsillectomized children?

24. Is there any regeneration of the tonsillar tissue in the tonsil fossa after operation?

25. Is there any hypertrophy of the lateral pharyngeal column or the lingual tonsil after tonsillectomy?

It is interesting to note that the lapse of ten years has given really definite answers to but few of these questions, the others remaining almost as much *sub judice* and as worthy of study as they were a decade ago.

II. Division of the work among the members of the American Laryngological Association.

The scheme of study outlined was so elaborate that no single small committee could do the work, and therefore it was apportioned among a number of subcommittees selected from the membership of the Association. These subcommittees were to investigate such points as the incidence of diphtheria and other throat infections among the tonsillectomized, the relation of the tonsils to arthritis and other systemic diseases, the pathology of the tonsil in general, the embryology of the tonsil, the effect of the tonsil on the voice, etc. The plan of work outlined was splendid in conception and encyclopedic in breadth, but impractical of execution.

The word impractical is used only after mature consideration. The American Laryngological Association is made up almost entirely of specialists of middle age who are deep in the daily practice of otolaryngology, in teaching those who some day will occupy their places and in contributing to the literature. Each member of the Association publishes articles on the subjects which are most attractive to him, and but few would have the time, the energy or the inclination to do a piece of assigned work which would require thorough literature search, sustained laboratory study or extensive clinical recording. A collective piece of clinical study, each member having only a small number of cases to study, would seem to be the most practical and least burdensome method of utilizing the vast clinical experience of the members of the Association.

III. The attempt to finance an investigation of laboratory type resulted in pledges of $950, this amount being contributed by ten members of the Association.

Dr. Jonathan Wright was consulted, and he suggested that the work should begin with the study of the physiology and function of the tonsil. He volunteered to oversee the work and to secure a worker who would put in a year on the subject for $1500. He later expanded his plan so as to include a clinical study both before and after operation, a study of the biochemistry of the tonsil, polariscope study of the lipoids in the tonsil and the distribution of the plasma cells.

Dr. J. Payson Clark interviewed Profs. Councilman, Theobald Smith, Cannon and Porter at considerable length. Dr. Clark con-

cluded that "From these different contributions and from my own observations we cannot hope, in the time at our disposal, to elucidate the whole subject of the physiology of the tonsil, which is so intricately involved with the physiology of the whole lymphatic system and obscure general biochemical processes.

The late E. Fletcher Ingals thought it possible that work could be done at the Sprague Memorial Institute and at no expense to the Association.

Conclusion. The original plan, in the judgment of the present Committee, while noble in conception, would be practicable only in a large clinic, where a combination of bacteriologic, histologic and morphologic study could be combined with the highest type of clinical investigation of the entire body, associated with trained laryngologic surgery. And it would take many, many years of study before the problems before us could be answered with finality.

The present Committee, therefore, suggests that one of three courses be adopted: (1) Either the Association should initiate a piece of work which should be restricted in scope, clear-cut in outline, quantitatively not burdensome, and of a nature to be shared in by the entire Association, or (2) it should pick out a certain phase of tonsil study of a laboratory nature and by subscription finance this work, or (3) the Committee should be dissolved and the Association leave this work to be done at the initiative of the interested individual.

If a collective study is to be made, your Committee suggests, for example, that the effect of tonsillectomy on the singing voice could be taken up with profit. Probably each member operates on at least five singers in the course of the year, and a careful study of these cases, reported on blanks which the Committee would prepare, should on analysis be of great and authoritative value.

If a fund is to be established for laboratory study the Committee would welcome suggestions or instructions from the Association as to the method or methods by which the money is to be raised and as to the problem to be attacked.

If the Association wishes neither to make any collective study nor to finance a piece of laboratory work, your Committee on Tonsil Investigation, unless other work is requested of it, asks

that this report be considered as its "swan song," and that it forthwith be discharged.

(Signed) J. Payson Clark,
Hill Hastings,
George L. Richards,
Henry L. Swain,
George Fetterolf,
Chairman.

Dr. Bryan urged that the report just read be referred to the Council for its careful consideration and with instructions that the Council take up this matter as suggested by the Committee in so far as the selection of workers is concerned. In reply to a question by the President, Dr. Pierce stated that the income of the Casselberry Fund could be used for the purposes outlined in Dr. Fetterolf's report.

Dr. Dean called attention to the fact that the National Research Council has headquarters in Washington and has a very large sum to be used for medical research. In order to secure the advantages of this fund, an individual with the degree of doctor of medicine or doctor of philosophy must devote all his time to a certain phase of research work. He believed that there was no question but that funds for this tonsil investigation would be available from this source.

## Report of the Candidates' Nominating Committee

The Candidates' Nominating Committee reported through Dr. Greenfield Sluder, of St. Louis, that a number of names had been under consideration and steps have been taken to secure the filing of application blanks by several younger men deemed worthy of Associate Fellowship. It was the desire of the Committee to seek out for this purpose younger men who were beginning to write and show promise of worthy work in the future. The President said that he believed that the idea under which this Committee was formed was that it was to follow up and keep track of prospective candidates, so that when any of them reached the stage where it was thought they were eligible to Fellowship,

the data concerning them could be submitted to the Council. Dr. Delavan thought that the function of this Committee was not thoroughly understood by it and that its function should be more definitely stated or that it should be discharged. Dr. Bryan agreed with the President's estimate of the function of the Committee and suggested that a list of prospective candidates, separate from those proposed for Membership, should be kept, and the data contained in regard to them laid before the Council from time to time. The report of the Candidates' Nominating Committee was accepted and the Committee continued.

### Report of the Nominating Committee

The Nominating Committee reported through Dr. Mosher, as chairman, that a meeting had been held on May 2, 1922, a quorum being present, and that the following names were nominated as Directors of the Association for the year 1922–23:

Dr. Emil Mayer, New York City.
Dr. George Fetterolf, Philadelphia, Pa.
Dr. Lorenzo B. Lockard, Denver, Col.
Dr. George M. Coates, Philadelphia, Pa.
Dr. J. Payson Clark, Boston, Mass.
Dr. Joseph H. Bryan, Washington, D. C.
Dr. Cornelius G. Coakley, New York City.
Dr. Norval H. Pierce, Chicago, Ill.
Dr. Harris P. Mosher, Boston, Mass.
Dr. Harmon Smith, New York City.

### Report of the Biographer and Historian

The report of the Biographer and Historian was presented by Dr. Delavan and will be found printed under Memorials.

### Miscellaneous Business

Dr. Dean moved that a committee of three be appointed to study the question of a proposed amalgamation with the American Otological Society and to confer with a similar committee from

that organization, with orders to report at some subsequent meeting.

Dr. Samuel Johnston, discussing this motion, said that he thought it would be a great mistake to either change the name of the organization or to add to it, however important it might be to bring the study of the ear into connection with that of laryngology. Having been instrumental in having this Association incorporated in order that it might receive bequests such as had already come to it from Dr. Casselberry and Dr. de Roaldes, he thought that the Association should continue unchanged, and that although we had been considered as holding ourselves aloof from all the societies and other men, that such was our privilege. This motion was duly seconded and carried by a vote of 20 to 8.

The recommendation of the Council that fifty dollars be appropriated for the expenses of the Abstract Editor was approved and the Abstract Editor was authorized to appoint an assistant as usual.

The following amendments to the By-Laws, recommended by the Council, were approved.

Amend Article VI by adding the following clauses:

7. That all cuts used to illustrate papers published by Fellows in the *Transactions* shall be paid for by the authors of the articles.

8. Unless the contributor is present at the meeting and reads, or is prepared to read, his paper, it shall not be published in the *Transactions* except by a special vote of the Council.

Drs. Coakley, Bryan and Mosher were nominated by the Association as members of the Board of Governors of the American College of Surgeons, representing the American Laryngological Association for the term expiring 1925.

On motion duly seconded and carried the meeting adjourned to take up the Scientific Program.

# EXECUTIVE SESSION

Wednesday, May 3, 1922

At the close of the Scientific Session the Executive Session was called to order by the First Vice-President, Dr. Dunbar Roy, at 12.15 P.M.

The election of officers being the first business, the ten Fellows selected previously for Directors of the Association were unanimously elected. The newly elected Directors thereupon retired to elect from among their body the officers of the Association for the year 1922–23. Dr. Bryan announced the following election of officers: Dr. Emil Mayer, President; Dr. George Fetterolf, First Vice-President; Dr. Lorenzo B. Lockard, Second Vice-President; Dr. George M. Coates, Secretary; Dr. J. Payson Clark, Treasurer; Dr. Joseph H. Bryan, Librarian; and as additional members of the Council, Drs. Cornelius G. Coakley, Norval H. Pierce, Harris P. Mosher and Harmon Smith.

It was moved and seconded that the Association tender a vote of thanks to the Washington members for their hospitality, courtesy and kindness to the visiting Fellows. This was carried by a rising vote.

A rising vote of thanks was tendered to Prof. Okada for his courtesy for coming such a great distance to give the Association the benefit of his work.

The Chair announced that the Committee to confer with a similar Committee of the Otological Society, relative to amalgamation, will consist of Dr. Joseph H. Bryan, chairman, Dr. Cornelius G. Coakley and Dr. Norval H. Pierce.

On motion, duly seconded and carried, the meeting adjourned.

# List of Fellows
# 1922

# LIST OF FELLOWS

1922

*Active Fellows*

1917. Arrowsmith, Hubert, 170 Clinton Street, Brooklyn, New York.
1915. Barnes, Harry Aldrich, 520 Commonwealth Avenue, Boston, Massachusetts.
1908. Barnhill, John F., 408 Penway Building, Indianapolis, Indiana.
1904. Berens, T. Passmore, 25 Park Avenue, New York.
1921. Berry, Gordon, 10 Elm Street, Worcester, Massachusetts.
1893. Birkett, Herbert S., 252 Mountain Street, Montreal, Canada.
1891. Bryan, Joseph H., 818 17th Street, Washington, D. C.
1913. Butler, Ralph, 1926 Chestnut Street, Philadelphia, Pennsylvania.
1915. Canfield, R. Bishop, Ann Arbor, Michigan.
1917. Chamberlin, William B., Osborn Building, Cleveland, Ohio.
1897. Clark, J. Payson, 71 Marlborough Street, Boston, Massachusetts.
1902. Coakley, Cornelius G., 53 West 56th Street, New York.
1917. Coates, George Morrison, 1811 Spruce Street, Philadelphia, Pennsylvania.
1905. Coffin, Lewis A., 114 East 54th Street, New York.
1903. Coffin, Rockwell A., 350 Commonwealth Ave., Boston, Massachusetts.
1893. Coolidge, Algernon, Jr., 613 Beacon Street, Boston, Massachusetts.
1913. Dabney, Virginius, 1633 Connecticut Avenue, Washington, D. C.
1917. Dean, Lee Wallace, Iowa City, Iowa.
1881. Delavan, D. Bryson, 40 East 41st Street, New York.
1921. Emerson, Francis P., 520 Commonwealth Avenue, Boston, Massachusetts.

1919. Faulkner, E. Ross, 101 East 58th Street, New York.
1914. Fetterolf, George, 2010 Spruce Street, Philadelphia, Pennsylvania.
1922. Forbes, Henry Hall, 40 E. 41st Street, New York.
1905. Freer, Otto T., 25 East Washington Street, Chicago, Illinois.
1879. French, Thomas R., 150 Joralemon Street, Brooklyn, New York.
1897. Frothingham, Richard, 616 Madison Avenue, New York.
1922. Goldsmith, Perry G., 84 Carlton Street, Toronto, Ontario.
1913. Goldstein, Max A., 3858 Westminster Place, St. Louis, Missouri.
1898. Goodale, Joseph L., 258 Beacon Street, Boston, Massachusetts.
1905. Grayson, Charles P., 262 South 16th Street, Philadelphia, Pennsylvania.
1906. Greene, D. Crosby, Jr., 23 Bay State Road, Boston, Massachusetts.
1917. Greene, Joseph B., Asheville, North Carolina.
1905. Halsted, Thomas H., 405 Fayette Park, Syracuse, New York.
1896. Hardie, T. Melville, 34 Washington Street, Chicago, Illinois.
1903. Harris, Thomas J., 104 East 40th Street, New York.
1915. Hastings, Hill, 924 Trust & Savings Bldg., Los Angeles, California.
1895. Hopkins, Frederick E., 25 Harrison Avenue, Springfield, Massachusetts.
1895. Hubbard, Thomas, 234 Michigan Street, Toledo, Ohio.
1919. Hurd, Lee Maidment, 39 East 50th Street, New York.
1920. Imperatori, Charles Johnstone, 17 East 38th Street, New York.
1904. Ingersoll, John M., 422 Osborne Building, Cleveland, Ohio.
1907. Jackson, Chevalier, 128 South 10th Street, Philadelphia, Pennsylvania.
1878. Johnston, Samuel, Greenway Apartments, Baltimore, Maryland.
1918. Kenyon, Elmer L., 104 South Michigan Boulevard, Chicago, Illinois.
1921. Kernan, John D., Jr., 156 East 79th Street, New York.
1894. Leland, George A., 354 Commonwealth Avenue, Boston, Massachusetts.
1914. Levy, Robert, Metropolitan Building, Denver, Colorado.

1918. Lewis, Fielding Otis, 259 South 17th Street, Philadelphia, Pennsylvania.

1911. Lockard, Lorenzo B., Metropolitan Building, Denver, Colorado.

1913. Loeb, Hanau W., 537 North Grand Avenue, St. Louis, Missouri.

1897. Logan, James E., 1208 Wyandotte Street, Kansas City, Missouri.

1915. Lynch, Robert Clyde, 632 Maison Blanche Building, New Orleans, Louisiana.

1921. McCullagh, Samuel, 17 East 38th Street, New York.

1913. McKimmie, Oscar A. M., 1330 Massachusetts Avenue, N. W., Washington, D. C.

1914. Mackenty, John E., 43 West 54th Street, New York.

1896. Mayer, Emil, 40 East 41st Street, New York.

1904. Mosher, Harris P., 828 Beacon Street, Boston, Massachusetts.

1914. Munger, Carl E., 81 North Main Street, Waterbury, Connecticut.

1901. Myles, Robert C., 11 East 48th Street, New York.

1922. New, Gordon B., Mayo Clinic, Rochester, Minnesota.

1903. Packard, Francis R., 302 South 19th Street, Philadelphia, Pennsylvania.

1906. Pierce, Norval H., 22 E. Washington Street, Chicago, Illinois.

1908. Randall, B. Alexander, 1717 Locust Street, Philadelphia, Pennsylvania.

1903. Renner, W. Scott, 341 Linwood Avenue, Buffalo, New York.

1897. Rhodes, John Edwin, People's Gas Building, Chicago, Illinois.

1884. Rice, Clarence C., 123 East 19th Street, New York.

1905. Richards, George L., 124 Franklin Street, Fall River, Massachusetts.

1902. Richardson, Charles W., 1317 Connecticut Avenue, Washington, D. C.

1913. Roy, Dunbar, Grand Opera House, Atlanta, Georgia.

1921. Sauer, William E., 537 North Grand Avenue, St. Louis, Missouri.

1907. Shambaugh, George E., 122 South Michigan Boulevard, Chicago, Illinois.

1909. Shurly, Burt R., 62 Adams Avenue W., Detroit, Michigan.

1919. Skillern, Ross H., 1928 Chestnut Street, Philadelphia, Pennsylvania.

1909. Sluder, Greenfield, 3542 Washington Avenue, St. Louis, Missouri.

1908. Smith, Harmon, 44 West 49th Street, New York.
1911. Stout, George C., 1611 Walnut Street, Philadelphia, Pennsylvania.
1889. Swain, Henry L., Colonial Building, 195 Church Street, New Haven, Connecticut.
1903. Theisen, Clement F., 172 Washington Avenue, Albany, New York.
1892. Thrasher, Allen B., The Groton, 7th and Race Streets, Cincinnati, Ohio.
1892. Wagner, Henry L., 518 Sutter Street, San Francisco, California.
1892. Watson, Arthur W., 126 South 18th Street, Philadelphia, Pennsylvania.
1908. Wilson, J. Gordon, 104 South Michigan Avenue, Chicago, Illinois.
1906. Winslow, John R., The Latrobe, Charles and Reade Streets, Baltimore, Maryland.
1922. Wishart, David J. G., 47 Grovsenor, Toronto, Canada.
1905. Wood, George B., 1830 Spruce Street, Philadelphia, Pennsylvania.

*Associate Fellows*

1922. Blair, Vilray P., 508 North Grand Avenue, St. Louis, Missouri.
1922. Lillie, Harold I., Mayo Clinic, Rochester, Minnesota.
1922. Monroe, Otho Lee, 24 East 48th Street, New York City.
1922. White, Francis W., 174 West 58th Street, New York City.

*Honorary Fellows*

1915. Bosworth, Francke H., 41 Park Avenue, New York.
1914. Cohen, J. Solis, 1833 Pine Street, Philadelphia, Pennsylvania.
1914. De La Sota Y Lastra, 7 Calle de Torqueros, Seville, Spain.
1922. Mackenzie, John N., 605 Washington Place, Baltimore, Maryland.
1910. Moure, E. J., 25 Cours du Jardin Public, Bordeaux, France.
1914. Thomson, Sir St. Clair, 64 Wimpole Street, W., London, England.
1921. Wright, Jonathan, Windy Rock, Pleasantville, New York.

*Corresponding Fellows*

1901. Collier, Mayo, Kearsney Abbey, Kent, England.
1893. Desvernine, Carlos M., 52 Cuba Street, Havana, Cuba.

1920. Ferreri, Gherardo, University di Roma, Rome, Italy.
1901. Grant, Sir James Dundas, 148 Harley Street, London, England.
1919. Kelly, Adam Brown, 26 Blythswood Square, Glasgow, Scotland.
1921. Le Maitre, Fernand, Avenue Victor Hugo, 120 (XVI), Paris, France.
1902. Lermoyez, Marcel, 20 Rue de la Boetie, viie, Paris, France.
1897. Luc, H., 15 Rue de Varenne, Paris, France.
1903. McBride, P., 20 South Drive, Harrowgate, England.
1919. McKernon, James F., 62 West 52nd Street, New York.
1896. Macdonald, Grevill, 85 Harley Street, Cavendish Square, London, W., England.
1894. MacIntyre, John, 179 Bath Street, Glasgow, Scotland.
1920. MacKenzie, Dan, care of Messrs. Adlard & Son, Bartholomew Close, London, England.
1896. Mygind, Holger, 31 Havnegade, Copenhagen, Denmark.
1919. Paterson, Donald Rose, 15 St. Andrew's Crescent, Cardiff, Wales.
1919. Rogers, John, Jr., 303 East 30th Street, New York.
1894. Sajous, C. E., 2043 Walnut Street, Philadelphia, Pennsylvania.
1896. Schmiegelow, Ernest, 18 Norregade, Copenhagen, Denmark.
1903. Tilley, Herbert, 72 Harley Street, Cavendish Square, London, W., England.
1913. Turner, Logan, 27 Walker Street, Edinburgh, Scotland.
1901. Wingrave, Wyatt, 11 Devonshire Street, Portland Place, London, W., England.
1894. Wolfenden, R. Norris, The Grange, Kent, England.

*Emeritus Fellows*

1914. Brown, J. Price, 106 South Drive, Toronto, Canada.
1922. Cobb, Frederic C., 11 Marlborough Street, Boston, Massachusetts.
1918. Farlow, John W., 127 Bay State Road, Boston, Massachusetts.
1918. Hinkel, F. Whitehall, 581 Delaware Avenue, Buffalo, New York.
1912. Lincoln, William, 1054 Rose Building, Cleveland, Ohio.
1922. MacCoy, Alexander W., Haverford Court, Haverford, Pennsylvania.
1914. Robinson, Beverley, 42 West 37th Street, New York.

## PAST OFFICERS

### *Presidents*

(Year of Election)

| | | | |
|---|---|---|---|
| 1879. | Louis Elsberg | 1901. | J. W. Farlow |
| 1880. | J. Solis-Cohen | 1902. | J. H. Bryan |
| 1881. | F. I. Knight | 1903. | J. H. Hartman |
| 1882. | G. M. Lefferts | 1904. | C. C. Rice |
| 1883. | F. H. Bosworth | 1905. | J. W. Gleitsmann |
| 1884. | E. L. Shurly | 1906. | A. W. de Roaldes |
| 1885. | Harrison Allen | 1907. | H. S. Birkett |
| 1886. | E. Fletcher Ingals | 1908. | A. Coolidge, Jr. |
| 1887. | R. P. Lincoln | 1909. | J. E. Logan |
| 1888. | E. C. Morgan | 1910. | D. Braden Kyle |
| 1889. | J. N. Mackenzie | 1911. | James E. Newcomb |
| 1890. | W. C. Glasgow | 1912. | George A. Leland |
| 1891. | S. W. Langmaid | 1913. | Thomas Hubbard |
| 1892. | M. J. Asch | 1914. | Alexander W. MacCoy |
| 1893. | D. B. Delavan | 1915. | G. Hudson Makuen |
| 1894. | J. O. Roe | 1916. | Joseph L. Goodale |
| 1895. | W. H. Daly | 1917. | Thomas H. Halsted |
| 1896. | C. H. Knight | 1918. | Cornelius G. Coakley |
| 1897. | T. R. French | 1919. | Norval H. Pierce |
| 1898. | W. E. Casselberry | 1920. | Harris P. Mosher |
| 1899. | Samuel Johnston | 1921. | Harmon Smith |
| 1900. | H. L. Swain | 1922. | Emil Mayer |

### *Vice-Presidents*

| | | | |
|---|---|---|---|
| 1879. | F. H. Davis | | |
| 1880. | W. C. Glasgow | | J. O. Roe |
| 1881. | E. L. Shurly | | W. Porter |
| 1882. | C. Seiler | | E. F. Ingals |
| 1883. | S. W. Langmaid | | S. Johnston |
| 1884. | J. H. Hartman | | W. H. Daly |
| 1885. | H. A. Johnson | | G. W. Major |
| 1886. | E. C. Morgan | | J. N. Mackenzie |
| 1887. | J. N. Mackenzie | | S. W. Langmaid |
| 1888. | W. C. Glasgow | | C. E. Sajous |
| 1889. | E. Holden | | C. E. Bean |
| 1890. | J. O. Roe | | J. H. Hartman |
| 1891. | M. J. Asch | | S. Johnston |
| 1892. | S. Johnston | | J. C. Mulhall |
| 1893. | J. C. Mulhall | | W. E. Casselberry |

| | | |
|---|---|---|
| 1894. | C. C. Rice | S. H. Chapman |
| 1895. | J. Wright | A. W. de Roaldes |
| 1896. | T. M. Murray | D. N. Rankin |
| 1897. | A. W. MacCoy | H. S. Birkett |
| 1898. | J. W. Farlow | F. W. Hinkel |
| 1899. | T. A. DeBlois | M. R. Brown |
| 1900. | H. L. Wagner | A. A. Bliss |
| 1901. | J. W. Gleitsmann | D. Braden Kyle |
| 1902. | G. A. Leland | T. Melville Hardie |
| 1903. | J. H. Lowman | W. Peyre Porcher |
| 1904. | Thomas Hubbard | W. J. Freeman |
| 1905. | J. L. Goodale | C. W. Richardson |
| 1906. | G. H. Makuen | A. B. Thrasher |
| 1907. | J. P. Clark | J. E. Rhodes |
| 1908. | E. Mayer | F. R. Packard |
| 1909. | C. G. Coakley | H. P. Mosher |
| 1910. | Robert C. Myles | J. M. Ingersoll |
| 1911. | F. C. Cobb | B. R. Shurly |
| 1912. | A. W. Watson | W. Scott Renner |
| 1913. | F. E. Hopkins | Geo. E. Shambaugh |
| 1914. | Clement F. Thiesen | Lewis A. Coffin |
| 1915. | J. Gordon Wilson | Christian R. Holmes |
| 1916. | Thomas H. Halsted | Greenfield Sluder |
| 1917. | John Edwin Rhodes | D. Crosby Greene |
| 1918. | G. E. Shambaugh | John R. Winslow |
| 1919. | Francis R. Packard | Harmon Smith |
| 1920. | Harmon Smith | W. B. Chamberlin |
| 1921. | Dunbar Roy | Robert C. Lynch |
| 1922. | George Fetterolf | Lorenzo B. Lockard |

*Secretaries and Treasurers*

| | | | |
|---|---|---|---|
| 1879. | G. M. Lefferts | 1895. | H. L. Swain |
| 1882. | D. B. Delavan | 1900. | J. E. Newcomb |
| 1889. | C. H. Knight | 1911. | Harmon Smith |

*Secretaries*

| | | | |
|---|---|---|---|
| 1912. | Harmon Smith | 1919. | J. M. Ingersoll |
| 1918. | D. B. Delavan | 1920. | George M. Coates |

*Treasurer*

1912. J. Payson Clark

*Librarians*

| | | | |
|---|---|---|---|
| 1879. | F. H. Bosworth | 1903. | J. H. Bryan |
| 1883. | T. R. French | | |

## PAST MEMBERS

**Deceased*

### *Honorary Fellows*

*1893. de Roaldes, Arthur, New Orleans, La.
*1880. Garcia, Senor Manuel, London. England.
*1914. Lefferts, George Morewood, Katona, N. Y.
*1883. Mackenzie, Sir Morell, London, England.
*1910. Massei, Ferdinand, Naples, Italy.
*1879. Oliver, H. K., Boston, Mass.
*1909. Semon, Sir Felix, Great Missenden, England.
*1914. Wagner, Clinton, New York City.

### *Corresponding Fellows*

*1892. Browne, Lennox, London, England.
*1887. Gouguenheim, A., Paris, France.
*1894. Holden, Edgar, Newark, N. J.
*1881. Labus, Carlo, Milan, Italy.
*1880. Meyer, Wilhelm. Copenhagen, Denmark.
*1881. Thornton, Pugin, London, England.
*1880. Whistler, W. McNeil, London, England.

### *Emeritus Fellows*

1914. Brown, J. Price, Cranbrook Lodge, Wycombe, Ontario, Canada.
*1914. De Blois, Thomas Amory, Boston, Mass.
1892. Farlow, John W., Boston, Mass.
*1914. Gleitsmann, Joseph W., New York City.
1888. Hinkel, F. Whitehill, Buffalo, N. Y.
*1912. Knight, Charles H., New York City.
1912. Lincoln, William, Cleveland, Ohio.
*1914. Porter, William, Ocean Springs, Miss.
1914. Robinson, Beverley, New York City.

*Active Fellows*

*1880. Allen, Harrison, Philadelphia, Pa.
*1878. Asch, Morris J., New York.
*1880. Bean, C. E., St. Paul, Minn.
*1893. Bliss, Arthur Ames, Philadelphia, Pa.
*1895. Boylan, J. E., Cincinnati, Ohio.
*1892. Brown, Moreau R., Chicago, Ill.
*1889. Casselberry, William E., Chicago, Ill.
*1883. Chamberlain, C. W., Hartford, Conn.
*1896. Chappell, W. F., New York.
*1882. Chapman, S. Hartwell, New Haven, Conn.
1918. Cox, Gerard H. New York.
1880. Cushing, E. W., Boston, Mass.
*1878. Cutter, Ephraim, West Falmouth, Mass.
*1880. Daly, W. H., Pittsburgh, Pa.
*1878. Davis, F. H., Chicago, Ill.
*1901. Dickerman, E. T., Chicago, Ill.
*1878. Donaldson, Frank, Baltimore, Md.
*1901. Freeman, Walter J. Philadelphia, Pa.
*1917. Friedberg, Stanton A., Chicago, Ill.
1901. Getchell, Albert C., Worcester, Mass.
*1907. Gibb, Joseph S., Philadelphia, Pa.
*1878. Glasgow, William Carr, St. Louis, Mo.
*1878. Hartman, Jacob H., Baltimore, Md.
*1879. Holden, Edgar, Newark, N. J.
*1907. Holmes, Christian R., Cincinnati, Ohio.
*1882. Hooper, Franklin H., Boston, Mass.
1893. Hope, George B., New York City.
*1901. Hyatt, Frank, Washington, D. C.
*1882. Ives, Frank L., New York City.
*1878. Ingals, E. Fletcher, Chicago, Ill.
*1880. Jarvis, William C., New York City.
*1878. Johnson, Hosmer A., Chicago, Ill.
*1879. Johnson, Woolsey, New York City.
*1879. Kealhofer, R. H., St. Louis, Mo.
*1901. King, Gordon, New Orleans, La.
*1885. Knight, Charles H., New York City.
*1878. Knight, Frederick Irving, Boston, Mass.
*1898. Kyle, D. Braden, Philadelphia, Pa.
*1880. Langmaid, Samuel W., Boston, Mass.

*1878. Lincoln, Rufus P., New York City.
*1888. Lowman, John H., Cleveland, Ohio.
*1919. Lynah, Henry L., New York.
*1879. McBurney, Charles, New York City.
*1885. McSherry, H. Clinton, Baltimore, Md.
*1898. Makuen, G. Hudson, Philadelphia, Pa.
*1881. Major, G. W., Montreal, Canada.
*1881. Morgan, E. C., Washington, D. C.
*1886. Mulhall, J. C., St. Louis, Mo.
1892. Murray, T. Morris, Washington, D. C.
*1881. Mynter, H., Buffalo, N. Y.
*1893. Newcomb, James E., New York City.
*1895. Nichols, J. E. H., New York City.
1894. Park, William H., New York City.
1892. Porcher, W. Peyre, Charleston, S. C.
*1880. Rankin, D. N., Allegheny, Pa.
*1879. Roe, John O., Rochester. N. Y.
1881. Robertson, J. M., Detroit, Mich.
*1878. Rumbold, T. F., St. Louis, Mo.
*1879. Seiler, Carl, Philadelphia, Pa.
*1893. Shields, Charles M., Richmond, Va.
*1878. Shurley, E. L., Detroit, Mich.
*1879. Smith, Andrew H., Geneva, N. Y.
*1892. Simpson, William Kelly, New York City.
*1879. Tauber. Bernhard, Cincinnati, Ohio.
*1899. Thorner, Max, Cincinnati, Ohio.
*1888. Van der Poel, S. O., New York City.
1896. Ward, Marshall R., Pittsburgh, Pa.
1879. Ward, Whitfield, New York City.
*1886. Westbrook, Benjamin F., Brooklyn, N. Y.
1896. Woolen, Green V., Indianapolis, Ind.
1890. Wright, Jonathan, Pleasantville, N. Y.

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